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THE SLEEP OF INFANCY AS RELATED TO PHYSICAL AND MENTAL GROWTH [1]

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PART I. INTRODUCTION

The following study was suggested to the writer by Professor C. F. Hodge, who, in a discussion of the subject, expressed the belief that in infancy, especially in human infancy, not only was the rhythm of sleep to be found, but also the genesis of sleep habits, for here there was an absence of volitional factors such as enter into the sleep of older persons, and which might possibly modify the sleep habits of mature animals.

The sleep of the human infant lends itself readily to observation. Much is known of it in a general way, though little has been done in the line of careful scientific research.

This study has taken as its line of investigation the sleep of the average infant in its normal environment of the home. All parents and caretakers are vitally interested in the subject of child growth and development, while in the thinking part of the community there is a vast fund of unformulated knowledge waiting the seeker who can combine facts into a concrete whole.

The first step in this study was the formulation of a method for keeping records of sleep and related conditions. The child is passing through the most critical stages of development in infancy, while it is also, from the nature of the case, most difficult to reach by the ordinary student of child life.

The method used is that of the chart given below. It was evolved with the two-fold aim, first of how and what to observe, and second and still more important, how to preserve most accurate records, with least effort to the observer.

[1] From the Biological Department, Clark University, Worcester, Mass.

Each chart is arranged for a week's observations. Longitudinal lines mark the days. The date and weather is recorded at the top of each longitudinal space. The twenty-four small squares following are for the hourly records, and are so planned that the record runs from six to six in the morning. This brings the day to instant observation at the top and the night directly under.

Items for each day's observation are sleep, food and time of feeding, noting if the child is waked for food. Then crying, which is intimately related to both nutrition and sleep, and which is a valuable index of the physical condition. Next, the dejections and vomiting are to be noted, and lastly, the time spent out of doors. These five items give at a glance the daily story and condition of infant life.

Below the smaller squares the amount and kind of food, if the child is artificially fed, are to be given. In the breast fed child, the chart should note the mother's condition, if any deviation from the usual routine occurs. Space follows next for the general care of the child. It is desirable to note the customary amount of " playing with and talking to " the child.

While quiet gentleness should characterize the environment, yet the imperceptible gradations from perfect quiet to all degrees of frolicking as the child grows ready for it, will be given by the judicious mother; she may never have formulated the fact that these are all external forces, *mental stimuli, acting directly on the delicate body and responsive brain, and all having more or less instant molding effect on the whole organism,* but her adaptation of stimulus to response is, or should be, what gives the " home baby " the best chance for development in a normal way.

All the above have been records of the environment of the child. The remaining space is to be utilized in the responses of the child to these various incident forces. The condition is best shown in the amount of life, vitality, *irritability in the physiological sense,* which is manifested. These developing responses, first shown in direct response to external stimuli, and a little later, when incident forces are not so much in evidence, as apparently spontaneous expressions, furnish valuable indices of both physical and mental growth.

Teething, creeping and walking are all important epochs in the developing child, and each marks the fact that the child is ready for a wider range of activity. The vocal sounds of infancy clearly indicate the psychophysiological condition. The cries early differentiate so that even the superficial observer may recognize their character, as expressing the condition of the child.

Date.
Weather
Pleasant
Cloudy
Storm, } rain, snow
Warm
Cold.

EXPLANATIONS

Each wide space across page includes one day. Each small square from above down includes one hour from 6 A M to 6 A M

Sleep.
Food and Water.
Crying
Dejection
Vomiting.
Outdoors.

Directions. For marking sleep, crying and outdoors, draw line down through corresponding hour and part of hour, for food, mark dot on corresponding part of square. If waked for food, mark with cross instead of dot. Mark w for water, v for vomiting. Mark dejection with d. For bowel movements, record, use capital first letter. Mark time in figures

A M 6 7 8 9 10 11 12
P M 1 2 3 4 5 6 7 8 9 10 11 12
A M 1 2 3 4 5

Weight
Sex.
Age

Amount and kind of food.
Amount of water
Mother's condition if breast-fed
Teething
Bath
Held.
Played with and talked to
Baby playing when played with.
Spontaneous play and exercise
Creeping
Walking.
Vocal sounds
Trying to talk "cooing" "la la ing," "goo goo," etc
Smiling and laughing
Observing
Fretting
Fear, pleasure and other emotions
Temperature if taken
Pulse if taken.
Respiration if taken.

The various cooing and gurgling sounds mark the contented state and indicate well being. After a little the obvious efforts of the infant to vocalize response to outer stimuli are in evidence; we see, on the one side pleasant feelings and sensations well up into the motor responses of smiling and laughing, together with general movements indicative of pleasure, or on the other side, unpleasantness through all stages from simple displeasure to absolute anger or fear.

The development of the power of observation by the child is all important. By it the hereditary capital may be indicated, and possibly, sometimes, potential lines of interest. The power of attention, evanescent in the early days of life, should later develop into ability to concentrate as needed. If absent it may indicate sensory defect.

The presence of the emotions indicates development while their order of appearance and intensity are clews to the degree and rapidity of development.

An all round study ought to co-ordinate daily weight records and weekly height records with sleep. An effort was made to keep records of weight and height, but with indifferent results.

The majority of the children studied have been seen often and their condition carefully discussed with the mothers, who have been most efficient allies in this research.

Records have been kept of thirty-six children whose ages range from birth to the fifth year. In the aggregate the records cover a period of more than seven years.

For purposes of comparison a few records are included of older children whose ages ranged from six to thirteen years; as are also those of a few adults. In this presentation, these are included in the tabulations of weather and sleep relations, in which they show the same relative changes as do the children in the first years of life.

This study, while centering on infant sleep, is comparative throughout. *The chief aim of the research has been an investigation of the origin and evolution of sleep, with the subsequent development of sleep habits.* For this, constant comparison is necessary, first, of human sleep at all ages, and second, of animal rhythms of activity and repose.

Literature

Each section of this study will refer briefly to literature under the respective subjects. From the very nature of sleep, it is inevitable that many sciences should contribute special studies upon it. A significant fact was recognized as the writings of pediatrists were first studied in this research, viz., that

while very little is found directly upon the subject of sleep, yet sleep and its conditions pervade all subjects as a most vital, though often unrecognized factor.

In speculative philosophy, chemistry, physics, and physiology, writers of each decade have formulated their conclusions regarding the phenomena of sleep. With the development of the microscope, and the perfection of histological technique, a number of theories of sleep developed from histological findings At the present time, experimental studies in physiology and psychology, as well as rapidly extending investigations in psychiatry, are rapidly adding theories from their individual standpoints.

Physicians have always been active in the investigation of sleep, and still more in the study of the causes and prevention of insomnia. Perhaps the most comprehensive résumé, at the date of publication, was that of Hammond, in 1868, on "*Sleep and Its Derangements.*"

In 1891, MacFarlene (14) published his valuable monograph on "*Insomnia.*"

In 1897, Manacéïne (15) published her book on "*Sleep,*" in its manifold aspects a valuable mine of facts on the subject.

Foster (9), from an evolutional standpoint, in 1901, offers the theory that "sleep is due to the limited capacity of the organism to receive and respond to stimuli, either through fatigue or lack of development." He notes "at one end of the series, fatigue alone causes sleep, while at the other end, it is due to lack of development."

Claparède (4), in 1905, in an exhaustive monograph, makes sleep a positive function, a means of defence for the organism. Sleep affords opportunity for potential building up of the cell before demands made upon it for expenditure of energy have made its building up a more complex, if not an impossible matter. Under normal circumstances, sleep precedes exhaustion, while repeated exhaustion produces insomnia. *It is not because we are exhausted that we sleep, but we sleep that we may not become exhausted.*

An extensive literature on sleep curves and the length of sleep will be discussed below.

Part II. Weather and Sleep

I. General Discussion of Weather and Sleep

An exhaustive study of the relations of weather and sleep is not practicable at this time. For such a task, numerous records of the character and length of sleep at all ages, coör-

dinated with exact conditions of barometric pressure, humidity, temperature, wind, electricity, and possibly radio-activity, prevailing at the time, together with the physical condition of the individual, all these data are necessary before conclusive formulation of the principles of interaction of meteorological factors and vital processes will be possible. To the above data we need to add the physiological rôle of oxygen in the body, and to study carefully the relation of bio-chemical cerebral processes to oxygen.

It is needless to say that the writer has not attempted anything as ambitious as this: Following a general discussion of the weather as related to sleep, the investigations which have already been made are reported.

The general atmospheric pressure is constantly fluctuating. Minute variations are without perceptible effect on metabolism; and mechanically changes of pressure on the body are compensatory, as fluids transmit pressure equally in all directions. Blood pressure has been measured at a height of six to seven thousand meters and found unchanged. Changes in vital processes at high altitudes and with a low barometer at ordinary altitudes are common. These changes, bio-chemical in nature, are closely associated with the resistance of the nervous system.

The coincidence of physiological changes and the sudden onset of pathological processes with sudden marked changes in the weather suggest the changes occurring in mountain sickness. An intensive study of the coincident changes in infant organisms and in the weather, might give valuable data regarding the genesis of mountain sickness. Aviation problems of the same nature are already demanding investigation.

Mosso, in his "Life in the High Alps," observed that in high altitudes "the effect of low barometric pressure was determined by the resistance of the nervous system" (its power of inhibition), "the greater the composure, the greater the resistance."

Disturbances of both pulse and respiration are common at high altitudes, as are also digestive disorders. These can all be traced to initial disturbances of the nervous system. Sleep in the Alps was characterized by respiratory pauses and periodic breathing. Mosso attributed the marked respiratory difficulties to the lack of carbon dioxid, and uses the term "acapnia" to denote the lack of sufficient carbon dioxid in the body to stimulate respiratory activity.

Fatigue in mountain climbing shows first in embarrassed respiration and circulation, then in nausea, vomiting and muscular weakness. Indiscretion in diet is followed by marked

diminution of muscular output. Overstrain produces elevation of temperature, while excessive fatigue has caused even death.

Fatigue at first often produces a feeling of increased strength very marked in nervous people. Those nearest nervous bankruptcy are often most prodigal of strength. All degrees of nervous activity are productive of fatigue, which may be ignored in the strong but must be intelligently regulated in the weak.

Lombard (American text-book Physiology) found that both regular and irregular changes with a falling barometer resulted in diminished muscular power. He concluded that a rising barometer favored the action of exercise, sleep, and digestion to increase muscular power, while a falling barometer might oppose or produce reverse conditions.

Other observers find a high barometer in cold weather stimulating to the nervous system. Vital activities proceed with greater ease and rapidity, though if the nervous system be unstable, the tendency toward undue expenditure of energy must be prevented. In the case of a nervous child, a quieter environment is advisable. In cases observed in this study, sleep changes were well balanced at these times. In the care of the infant, it must be borne in mind that the range of infant adaptation is small, and care in dealing with minor degrees of fretfulness will prevent the development of undue irritability. Under the same conditions as in infants, irritability has been noted in older children and in adults. In fact, even casual observation demonstrates all shades of increased response, from *aliveness,* to uncontrollable irritability at such times.

Humidity is a complex factor, being closely dependent upon temperature and wind. The excretion of water through the skin is directly related to the amount of water in the surrounding air and may be reduced even 75 per cent. without disease if the nervous mechanisms are intact. The smaller the body, the greater the metabolism in proportion to the size, and the quicker the need of adequate adjustment. Intolerance to air saturated with moisture increases in direct proportion to the temperature.

On the other hand, the dryness of the average home is out of all proportion to the moisture necessary for physiological fitness. Low humidity induces a chronic neurotic state in which inhibition is difficult. All but the strongest show the effects in irritability and mild insomnia. Ability to do mental work is diminished and sustained mental work can only be done with danger to the individual.

Acute inflammatory conditions of the respiratory tract are

caused by very dry air and gastro-intestinal disorders by excessive moisture. While moist warm air is soothing to mucous membranes, a prolonged exposure is likely to be followed by lost appetite, digestive disturbances, and imperfectly performed nervous functions.

In high temperature and humidity, not only is oxygen tension less, but interference with the heat regulating function of the skin may markedly embarrass vital processes. Both circulation and respiration may be impeded and the mental instability, shown by either marked irritability or depression, may be great. Under such circumstances digestive disorders are prone to occur, and these are increased and intensified by the abundant bacterial growth flourishing at such times.

The proper regulation of clothing is as dependent upon humidity as upon temperature. Light and porous clothing is necessary in high temperature and humidity, while heavier clothing is needed in exposure to cold with high humidity.

Temperature. Each individual and species has its optimum of temperature, below or above which it can adjust to a certain degree and still maintain itself. The younger and the weaker the organism, the more difficult the adaptation, and the smaller the range of adaptation. Heat favors growth and cold limits it. If breeders wish to produce a small species of an animal, they cause its birth in the fall and keep it in a cold place through the winter. Less food is needed if warmth is abundant. Individuals of low vitality need both extra food and heat.

The beneficial effects of properly regulated cold are marked as regards the nervous system. The effect is shown by improved appetite and digestion, a stronger heart action and refreshing sleep. The skin and vaso-motor system show the effect in better regulation of temperature and circulation.

Heat markedly lessens muscular tone, and this means a general relaxation of the vaso-motor system as well as of the voluntary muscles. A child with weak digestive powers will need more care in hot weather. Cold combined with high humidity will throw more work on both lungs and kidneys; the child of less resistance in these organs will contract colds and develop pulmonary and renal lesions more readily at such times, and disturbed sleep is common; forethought should provide additional opportunity for rest, which may be all that is needed to keep the organism in order.

Light. The direct effect of light on sleep is ordinarily to decrease its depth. Light in certain amounts is essential for growth and development; but the early stage of growth of all life is protected from light. For the normal child as for the

adult, night sleep is much more beneficial than day sleep of equal length. Experimenters have found the day sleep less restful and continuous and more superficial than night sleep. Night nurses in hospitals suffer from a chronic state of fatigue, which makes mental work more difficult and unsatisfactory than when on "day duty." Organic functions are much more active and intense during day than during night sleep.

On the other hand, there are border-line cases, which do not sleep in the absence of light. Some children, persistently wakeful, can be made to sleep if a bright light is taken into the room. Cases have been noted in which the onset of undue fatigue is first noted by inability to sleep in the dark, and the condition disappears as soon as sufficient rest has been obtained. Nocturnal asthma may be lessened if a light be present.

Lack of sunlight results in mental and physical depression and also loss of appetite, and indigestion. An irregular type of remittent fever is sometimes seen in servants and others who pass much of their time or sleep in rooms partly underground.

Oxygen. The action of oxygen is predominant in vital activities. In the body its first and most important effect is on the brain. Growth processes are synthetic and oxygen is necessary for their occurrence. Lack of oxygen first affects the cerebral hemispheres, and especially affects the ganglion cells. In death from lack of oxygen, the respiratory centers undergo irreversible changes in a very short time. Marcet says the direct action of oxygen on the brain is necessary for volition. Loeb makes the function of associative memory depend upon oxygen and further suggests that the lack of oxygen may affect the colloids of the brain. Alveolar oxygen can sink from 113 to 30 mm. without causing absolute inefficiency, but the brain suffers first. The ability to absorb oxygen is weakened by low body temperature, acute infections and conditions lowering vitality.

In all the children studied, the influence of the time spent out of doors has shown markedly, both in the improved character and length of sleep, and also in the gain of the child generally. The vigor of growth of a child kept out of doors or in fresh air is in marked contrast to the average puny indoor child, even if otherwise the conditions are the same. Sleep is normal and refreshing, and growth progressive in abundance of air.

The effect of a lack of fresh air, when the brain is increasing most rapidly and forming its habits of response and adap-

tation, and is in most need of oxygen, and when the organism is least able to combat infections and regulate its heat mechanisms, may never be remedied.

The change in a sick child, taken from a close, ill-ventilated room, to the fresh out-of-door air, is marvellous. The beneficial results are seen at once in the marked improvement in any disease. Vital functions are stimulated at the center, that is, the brain, on which, as the part of the organism whose function is primarily the correlation of inner and outer conditions to serve its varying needs. The stimulating effect is at once productive of renewed activity in all parts of the organism.

The normal child needs the out-of-door life much more than does the invalid. The present tendency to give all the essential things of life to the crippled and defective, needs to be halted long enough to *insist on the best things of life for the normal child, if the race and individual are to be advanced.* Give the invalid and the defective child all the care and attention available, but make conditions such that the normal child will not have to become imbecile or crippled before he can secure opportunities for physical and mental instruction and growth.

It is not a question of being able to live that is at issue. Growth is necessary, if physical and mental ability are to be attained. The irritable or apathetic child who worries out a parasitic existence in a way most depressing for all concerned, and the vigorous, strong, active child, who will later carry responsibility, advance the race and add to its resources, are perhaps the extreme results of what is called on the one hand "unfavorable surroundings" and on the other a "favorable environment." *Stunted, retarded growth in these early stages, when all authorities are agreed that formative processes are most active and most responsive to modification, means permanent crippling of the organism.*

Finally, the child ought to be studied with reference to his individual reaction to the weather. Conditions of weather in which he is observed to be restless and irregular in his sleep and irritable and fretty during waking hours, ought to be times of more careful attention to secure needed rest, and prevent undue fatigue, while the diet should also be more carefully regulated. A child of the "nervous type," even if considered normal, at times when he is observed to be more restless "unable to keep still," cross, unreasonable, etc., ought to be kept under such conditions that quiet is assured, and to be allowed to vegetate until his organism has became trained to work automatically in a more economical way. On

the other hand, a fat phlegmatic child may well be stirred up and his fat trained off by stimulation and exercise coinciding with stimulating weather conditions.

II. Length and Character of Sleep with Coincident Meteorological Conditions

The length and also the character of sleep in the children under observation have been carefully studied, in connection with coincident barometric pressure, humidity, temperature, and wind.

Tables I to III are based on fluctuations in the length of sleep, while Table IV gives in full the conditions of barometer, humidity, temperature and wind, together with the length of sleep at the time in a number of the children under observation. Changes involving one-quarter of an hour and above have been taken into account.

The graphic chart will show at a glance the character of these changes.

While daily variations are, as a rule, slight, yet falls or rises of one to three hours are by no means uncommon, with the change in the weather as the only obvious cause.

"Taking cold" is often given as a cause of disturbed sleep. No. 3, a sturdy boy of eighteen months, who had "always been absolutely well," showed this in a striking manner, as he contracted the first cold of his life at a time of marked decrease of humidity. The cold naturally was the cause of much disturbance in sleep in the two nights following.

Changes in the length of sleep, while showing individual differences, grouped as a whole for all the cases in the time studied, give as regards barometer and sleep changes:

Sleep increases or decreases in an equal number of cases with either a rising or a falling barometer.

As regards humidity, the records show that *sleep increases or decreases with either rise or fall in practically an equal number of cases.*

Humidity is a complex factor, and it is more than doubtful in cold weather, how accurately the effect of humidity alone can be estimated. The records of Table IV are taken from April and September, to obviate this criticism.

The significant fact in the summaries is the mutual balancing of the various changes. On the other hand, careful scrutiny of individual records in Table I will suggest that each child may have his own characteristic response to weather changes, careful attention to which will materially aid in adaptation of care to physiological conditions.

It is a matter of daily observation by physicians, that dis-

turbances of all degrees, from simple restless sleep, to actual disease, often coincide with changing weather. In the first and second year, while the child is undergoing such marked change and development, adjustment is not the easy matter it may be later in life.

The few cases of changes of sleep with even barometer are inconclusive, as atmospheric fluctuations are always going on, though they may not show in the averages.

The barometer records used were averages of two-hour records taken during the twenty-four hours. Temperature is also averaged from two-hour records. Humidity is based on the average of morning and evening records. When wind velocity is given, it is based on the averages of the twelve-hour day and night periods.

The maintenance of an average amount of normal sleep advantageous to the individual, in spite of atmospheric changes, suggests both the range of adaptability of the organism and the nature of the compensatory changes. (Attention should be called to a study by Rowe (17), which has followed similar lines to the present research. Rowe concludes that not the *length* of the sleep, but the *quality,* is the better criterion of disturbances caused by meteorological changes.)

III. Study of Sleep with Coincident Weather

In the study of individual records of weather and sleep, one or two typical cases will be sufficient as an example of all. A brief glance at Table I will demonstrate that each record suggests its own individual character.

No. 1 in the first year shows a slight preponderance of sleep changes, as sleep falls with barometer and humidity; while in the second year, the sleep rises with fall of barometer and seems little influenced by humidity.

This child's curve of sleep is more influenced by general atmospherical changes than by humidity alone, as are some of the others. When the humidity reached 80 per cent. or more, the sleep usually increased.

At one time a humidity of 100 per cent. coincided with a loss of sleep of three hours, while the entire night's sleep was restless and broken. At a subsequent time a quick rise of humidity to 100 per cent. coincided with an hour's increase in sleep.

A rainy season in October in this record coincides with a period of much less sleep. This was explained as due to the daily sleep on the piazza being prevented. The child never slept as well in the house. This fact crops up as a disturbing factor in all children studied who were accustomed to take their daily naps out of doors. In all these cases the daily nap was not only disturbed and restless, but the sleep of the night was also often restless and unsatisfactory.

For the boy under discussion, the habit of sleeping out of doors was so deeply fixed and the persistence so great that on a few occasions the mother wrapped him up warmly and put him under an umbrella, though

it was snowing hard. Whenever this was done, he went to sleep and had a long refreshing nap, though in the house he waked every few moments and was always fretty.

Other records are similar to this. In some records, the response was evidently to the conditions of humidity rather than the general changes. No. 26, a boy of three months of age showed this markedly, always sleeping better if the humidity was high. Through his third to his sixth month, he was kept out of doors all day. Late in September, the weather getting colder, it was not thought possible to keep him out doors. The house being very dry, he speedily developed an irritated condition of the respiratory passages, and then suddenly developed an acute laryngitis and broncho-pneumonia, which ended fatally in a few days. The marked dry condition of the whole respiratory tract was a prominent feature of the case.

The records of older children and of adults show practically the same results as those of the younger children. The length of sleep is more uniform, the change less marked in the normal adult, while the number of even periods of sleep is much more in the adult than in the child. In proportion to adult fatigue, the response of sleep to weather changes is more marked and unfortunately, tends toward the side of a loss of equilibrium too often. If this tendency exists, an intelligent recognition of the fact will avail the individual much, as often slight precautions are all sufficient to avert trouble.

The effect of cold can usually be studied only in an indirect way in infancy. Several babies under observation took their daily naps out of doors nearly every day through the winter and thrived. Modifications were also made, in that the child was put to sleep in an unheated room, with all the windows wide open. Cold is a stimulant, if the child is properly protected, and the child responds by markedly increased metabolism.

Heat in undue amount is enervating. While it is essential that premature and puny children be kept at an even warm temperature, it is even more imperative that they be supplied with fresh air. The need of oxygen is urgent in these cases. Some children do better in warm weather, but hot days are very relaxing and care should be exerted to keep them as cool as possible. Some of the children under observation show long periods of sleep in the hottest days.

Upon the influence of wind upon sleep little could be learned. One of the children was apt to be more quiet on windy days. No. 1 was inclined toward irritability, and demanded more care. In a few instances both day and night sleep has increased in windy weather. Of course, the effect is so interwoven with the often abrupt barometer changes that it is difficult to say how much is due to each factor. Results were tabulated as under barometer and humidity, but the tables showed no correlation and have been discarded.

TABLE I

SUMMARY OF INDIVIDUAL RECORDS OF SLEEP, BAROMETER, HUMIDITY AND WIND CHANGES, BIRTH TO FIVE YEARS OF AGE

	I	II	III	VI	VII	VIII	X	XI	XIII	XVII	XVIII	XXII	XXIII	XXVI
Barometer:														
Sleep rise with rise..	43	19	0	22	25	9	11	6	8	16	9	6	4	22
Sleep rise with fall..	44	13	2	19	34	7	22	6	24	20	9	5	6	24
Sleep rise with even.	1	0	1	0	1	0	0	1	1	1	1	0	1	0
Sleep fall with fall..	51	16	0	18	30	12	17	8	27	14	7	6	5	16
Sleep fall with rise..	39	9	4	21	26	4	18	10	18	19	9	3	6	22
Sleep fall with even.	2	1	0	1	1	0	2	0	1	0	0	1	0	0
Sleep even with even	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Sleep even with rise.	10	1	0	3	5	2	6	1	3	6	0	2	1	1
Sleep even with fall.	11	5	1	5	5	4	4	0	0	9	4	2	2	0
Humidity:														
Sleep rise with rise..	36	17	2	17	27	7	17	8	16	14	7	4	5	23
Sleep rise with fall..	44	12	1	19	29	10	14	5	26	18	12	7	6	22
Sleep rise with even.	0	1	0	0	1	0	0	0	0	1	0	0	0	0
Sleep fall with fall..	38	11	3	18	27	6	22	11	21	13	6	5	6	19
Sleep fall with rise..	39	16	1	19	28	8	12	8	21	13	9	5	5	19
Sleep fall with even.	2	0	0	0	1	0	0	0	0	1	0	0	0	2
Sleep even with even	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Sleep even with rise.	11	3	0	5	3	2	3	0	2	6	2	2	1	1
Sleep even with fall.	8	3	1	3	6	2	4	0	1	10	2	2	2	0

TABLE I—*Continued*

SUMMARY OF INDIVIDUAL RECORDS OF SLEEP, BAROMETER, HUMIDITY AND WIND CHANGES, BIRTH TO FIVE YEARS OF AGE

	XXVII	XXVIII	XXIX	XXX	XXXIII	XXXIV	Newborn XV	Newborn XIX	Newborn XX	XIX	XXIV	XXV	XXXV	Total
Barometer:														
Sleep rise with rise..	31	12	6	16	15	8	2	3	3	4	1	0	5	306
Sleep rise with fall..	32	7	4	12	19	7	1	5	4	2	3	2	3	336
Sleep rise with even.	1	0	0	3	0	3	0	0	0	1	0	0	0	16
Sleep fall with fall..	36	11	5	17	12	11	3	4	2	6	5	2	5	344
Sleep fall with rise..	33	12	4	13	20	10	0	1	3	1	2	2	4	313
Sleep fall with even.	0	0	0	0	2	0	0	0	0	0	0	0	0	11
Sleep even with even	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sleep even with rise.	12	1	3	0	3	1	0	0	0	0	0	0	2	63
Sleep even with fall.	5	0	4	5	7	1	0	0	0	0	0	0	0	74
Humidity:														
Sleep rise with rise..	32	9	4	18	17	10	2	4	3	2	4	1	6	312
Sleep rise with fall..	32	10	6	13	17	9	0	3	4	5	0	1	2	327
Sleep rise with even.	1	0	0	0	0	0	0	0	0	0	0	0	0	4
Sleep fall with fall..	34	11	4	16	13	10	2	2	3	2	4	2	5	314
Sleep fall with rise..	37	11	5	14	20	11	0	3	3	5	3	2	4	321
Sleep fall with even.	2	1	0	1	1	0	0	0	0	0	0	0	0	11
Sleep even with even	1	0	1	0	0	0	0	0	0	0	0	0	0	4
Sleep even with rise.	7	0	3	4	6	2	0	0	0	0	0	0	0	63
Sleep even with fall.	9	0	3	1	4	1	0	0	0	0	0	0	2	60

TABLE II

SUMMARY OF SLEEP CHANGES, CORRELATED WITH BAROMETER AND HUMIDITY CHANGES, FROM BIRTH TO THE FIFTH YEAR

	First Year										
	I	II	VI	VIII	X	XI	XIII	XXVI	XXVII	XXX	Total
Barometer:											
Sleep rise with rise	22	19	22	9	11	6	8	22	31	16	166
Sleep rise with fall	20	13	19	7	22	6	24	24	32	12	179
Sleep rise with even	0	0	0	0	0	1	1	0	1	3	6
Sleep fall with fall	28	16	18	12	17	8	27	16	36	17	195
Sleep fall with rise	17	9	21	4	18	10	18	22	33	13	165
Sleep fall with even	1	1	1	0	2	0	1	0	0	0	6
Sleep even with even	1	0	0	0	0	0	0	0	0	0	1
Sleep even with rise	6	1	3	2	6	1	3	1	12	0	35
Sleep even with fall	3	5	5	4	4	0	0	0	5	5	31
Humidity:											
Sleep rise with rise	21	17	17	7	17	8	16	23	32	18	176
Sleep rise with fall	20	12	19	10	14	5	26	22	32	13	173
Sleep rise with even	0	1	0	0	0	0	0	0	1	0	2
Sleep fall with fall	18	11	18	6	22	11	21	19	36	16	178
Sleep fall with rise	20	16	19	8	12	8	21	19	33	14	170
Sleep fall with even	2	0	0	0	0	0	0	2	0	1	5
Sleep even with even	1	0	0	0	0	0	0	1	0	0	2
Sleep even with rise	6	3	5	2	3	0	2	1	12	4	38
Sleep even with fall	3	3	3	2	4	0	1	0	5	1	22

TABLE II—Continued

	Second Year					Third to Fifth Year							
	I	III	VII	XXVIII	Total	XVII	XVIII	XXIII	XXIX	XXXIII	XXXIV	XXII	Total
Barometer:													
Sleep rise with rise...	21	0	25	12	58	16	9	4	6	15	8	6	64
Sleep rise with fall...	24	2	34	7	67	20	9	6	4	19	7	5	70
Sleep rise with even..	1	1	1	0	3	1	1	1	0	0	3	0	6
Sleep fall with fall...	23	0	30	11	64	14	7	5	5	12	11	6	60
Sleep fall with rise...	22	4	26	12	64	19	9	6	4	20	10	3	71
Sleep fall with even..	1	0	1	0	2	0	0	0	0	2	6	1	9
Sleep even with even.	0	0	0	0	0	0	0	0	0	0	0	0	0
Sleep even with rise..	4	0	5	1	10	6	0	1	3	3	1	2	16
Sleep even with fall..	8	1	5	0	14	9	4	2	4	7	1	2	29
Humidity:													
Sleep rise with rise...	15	2	27	9	53	14	7	5	4	17	10	4	61
Sleep rise with fall...	24	1	29	10	64	18	12	6	6	17	9	7	75
Sleep rise with even..	0	0	1	0	1	1	0	0	0	0	0	0	1
Sleep fall with fall...	20	3	27	11	61	13	6	6	4	13	10	5	57
Sleep fall with rise...	19	1	28	11	59	13	9	5	5	20	11	5	68
Sleep fall with even..	0	0	1	1	2	1	0	0	0	1	0	0	2
Sleep even with even.	0	0	0	0	0	0	0	0	1	0	0	0	1
Sleep even with rise..	5	0	3	0	8	6	2	1	3	6	2	2	22
Sleep even with fall..	5	1	6	0	12	10	2	2	3	4	1	2	24

TABLE III

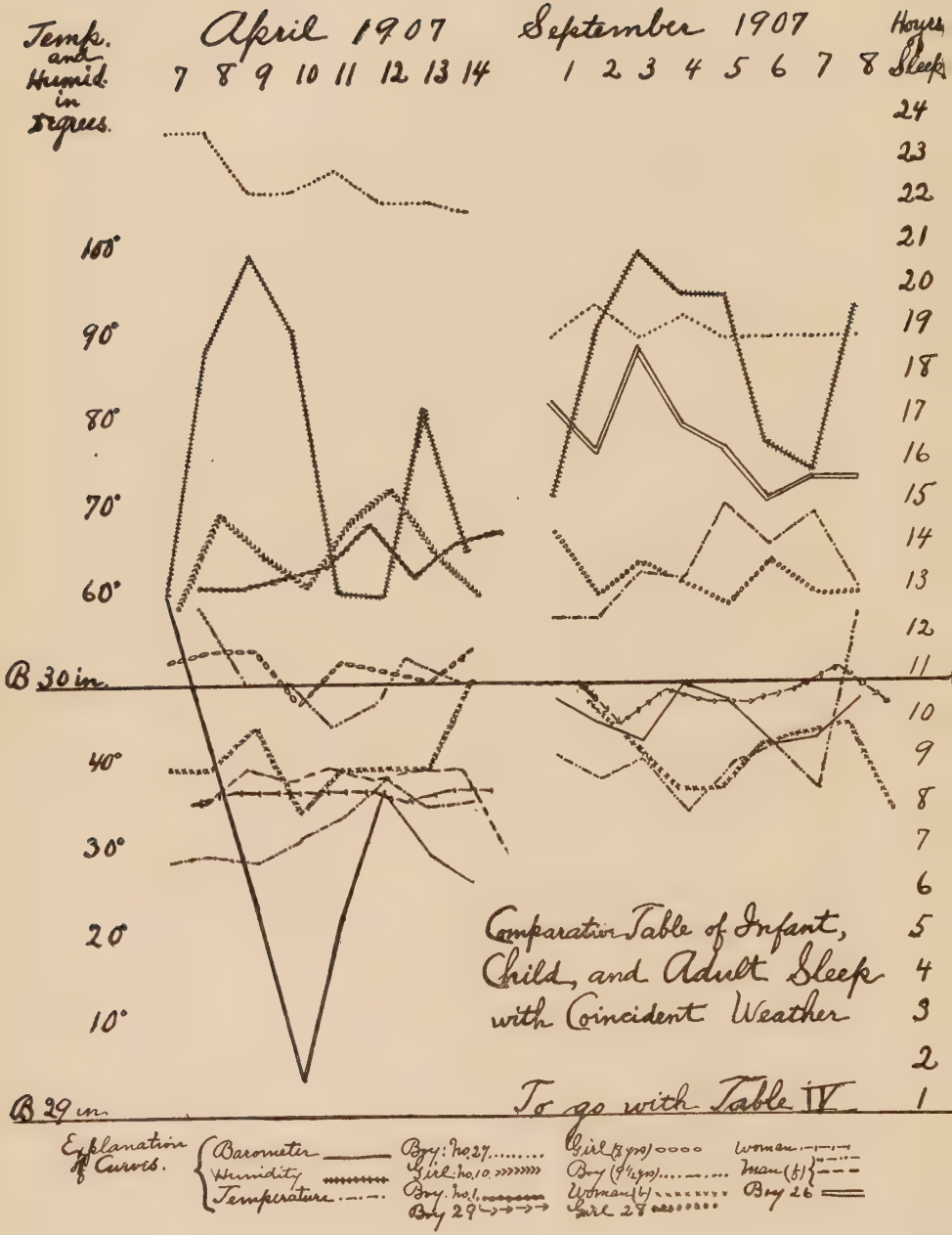
SUMMARY OF ALL RECORDS, BIRTH TO ADULT LIFE

Barometer:	New born	1st year	2nd year	3rd to 5th year	Total, 0 to 5 years	6 to 13 years	Adult	Total, all ages	Humidity				
									1st month	1st year	2nd year	3rd to 5th year	Total, 0 to 5 years
Sleep rise with rise . . .	18	166	58	64	306	11	15	332	22	176	53	61	312
Sleep rise with fall. . . .	20	179	67	70	336	9	18	363	15	173	64	75	327
Sleep rise with even . .	1	6	3	6	16	2	15	33	0	2	1	1	4
Sleep fall with fall. . . .	27	195	64	60	346	15	14	375	20	178	61	57	316
Sleep fall with rise. . . .	13	165	64	71	313	6	9	328	20	170	59	68	317
Sleep fall with even . .	0	6	2	3	11	2	0	13	0	5	2	2	9
Sleep even with even .	0	1	0	0	1	1	1	3	0	2	0	1	3
Sleep even with rise . .	2	35	10	16	63	8	11	82	0	38	8	22	68
Sleep even with fall . .	0	31	14	29	74	6	9	89	2	22	12	24	60

TABLE IV

COMPARATIVE TABLE OF INFANT, CHILD AND ADULT SLEEP, WITH COINCIDENT WEATHER CHANGES

Date, 1907	Sleep Rise	Sleep Fall	Sleep Even	Barometer	Humidity, Per Cent	Temperature, Degrees	Wind, Ave. Miles per Hour	Hours of Sleep in 24 Hours							
								Boy XXVII	Girl X	Boy I	Girl (8 yrs.)	Boy (9½ yrs.)	Woman (b)	Woman	Man (f)
April 7	2	3	3	30.21	62	29	8	23	11¾	12¼	10½	11¾	8	7¼	8
8	3	3	3	29.85	89	30	10½	23	14	12¼	10¾	10	8	7½	8
9	2	4	3	29.48	100	29	17½	21½	13	12½	10¾	10	9	7½	7¾
10	3	5	1	29.08	92.5	32	11	21½	12¼	12¾	9½	9	7	7½	8
11	6	2	1	29.46	62.5	34.5	11	22	13¾	13¾	10½	9½	8	7½	7¾
12	3	4	2	29.75	62	38.5	6	21¼	14½	12½	10¼	10½	8	7¼	8
13	2	4	3	29.60	84	36	9½	21¼	13	13¼	10	9	8	7½	8
14	4	3	2	29.54	65.5	36.5	13½	21	12	13½	10¾	9	10	7½	6
1907								Boy XXVI	Boy XXVII	Girl XXVIII	Boy XXIX	Woman (b)	Man (f)		
Sept. 1				29.97	73	57.5	8	16½	18	13½	10	9½	8¼		
2				29.91	91.5	57.3	4	15½	18¾	12	9	8½	7¾		
3				29.87	100	63.2	6	17¾	18	12¾	9¾	7½	8¼		
4				29.99	95	62	4	16	18½	12¼	9½	7½	7		
5				29.96	95	70.2	6	15½	18	11¾	9½	8½	8		
6				29.85	77.5	66	6	14¼	18	12¾	9¾	8¾	8½		
7				29.86	74.5	69.7	5½	14¾	18	12	10¼	9	7½		
8				29.96	93.5	61.7	3½	14¾	18	12	9½	7	11½		


Temp. and Humid. in degrees.
April 1907
September 1907
Hours Sleep
7 8 9 10 11 12 13 14
1 2 3 4 5 6 7 8
100°
90°
80°
70°
60°
B 30 in.
40°
30°
20°
10°
B 29 in.
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Comparative Table of Infant, Child, and Adult Sleep with Coincident Weather
To go with Table IV
Explanation of Curves.
Barometer
Humidity
Temperature
Boy: No 27
Girl No 10
Boy. No 1
Boy 29
Girl (2 yrs)
Boy (7½ yrs)
Woman (4)
Girl 28
Woman
Man (5)
Boy 26

Part III. Food and Sleep

I. Study of Food and Sleep Relations in Children Under Observation

The records kept include both breast-fed children and those fed with modified milk. All the children were well cared for, with one or two exceptions, concerning the food given, and all gained during the time under observation. Two or three records will be summarized as typical of all.

No. 1, child born by induced labor at the seventh month, owing to severe nephritis of the mother; the child weighed two and one-quarter pounds. The mother insisted upon nursing him, though the physician in charge strongly opposed it. The child gained a pound the first week and at three months of age weighed twelve and three-quarter pounds.

Sleep was regular and good. An occasional scanty supply of breast milk necessitated artificial feeding once or twice daily, and the sleep was not as good during these periods. The child gained in the normal, uneventful way throughout infancy. At sixteen months of age, he began walking, had seven teeth, was sleeping continuously through the night, and, it is needless to say, was a happy, active and responsive child.

No. 2, fed on modified milk, slept in a regular, normal way, and the night's sleep was usually continuous. When five months old, he had a period of being dissatisfied with the amount of food, annd would "fuss and cry" until the next feeding time. Increase of the food was followed by disappearance of the "fussiness." At this time sleep was not affected, but at a later period he waked early in the morning and demanded a meal, after which he went to sleep at once. A further increase in the food was followed by sleep lasting until the later waking time.

No. 6 showed a different feature of the subject. She was a feeble child and fed on modified milk. For some time she cried a good deal and later slept in a heavy, lethargic way, and it became difficult to arouse her at all or to get any food swallowed. After being taken to the country and kept out of doors, she began to take food better, sleep became normal and she began to gain in every way.

No. 26, fed on sterilized milk, came under personal observation first for professional care for a crop of boils which covered the entire scalp and had been treated as eczema. Under a diet of modified plain milk and surgical treatment for the boils, sleep, which had always been broken and short, improved at once.

This child was under observation during the hot months, and while the milk supply was obtained fresh from the farm, the fluctuations of digestive disturbances, coinciding with disturbances of weather, and always resulting in disturbed or lost sleep, emphasized the fact that there is nothing so necessary for a delicate child as mother's milk.

Study of other cases, however, emphasizes the other side of the question, namely, that between a sick mother and a healthy cow, the balance is decidedly in favor of the cow.

No. 29, a healthy breast-fed child through the first year, had always slept well. He was weaned abruptly at this time, and refused food so long and persistently that he was in actual danger of starvation before he could be made to eat. Since that time he has been a fretful, irritable child, nervous and capricious, with a poor appetite and always sleeping badly. He is subject to nocturnal asthma, is a timid child, and this is

naturally more marked in the early morning hours. Bad dreams are frequent and the contrast to the happy, contented baby of the first year is striking.

II. Nutritive Disturbances, Sleep and Insomnia

A thoughtful consideration of the above records, both of the children who never had a recognized illness, and those who were temporarily not well, will emphasize the ease with which physiological processes shade imperceptibly into pathological conditions, under certain not always recognized or known circumstances. This is a common feature of child life and it often is an even chance whether a certain condition will right itself or pass into actual disease. Association of food and sleep is very intimate in infancy, and disturbance in either tends to involve the other. The younger the child the more and the surer the disturbance.

A form of inanition fever present in the child shortly after birth is often due to the absence of food at this time. Crandall describes the symptoms as follows: "The child, who perhaps, has been restful and quiet, becomes irritable and restless. It worries and cries and gets its fingers or anything else it can into its mouth. If the temperature be not taken, the fever may be overlooked. The fever is usually at its height on the third or fourth day. The fall is very rapid if food is given freely. The treatment consists in a proper supply of food."

Holt notes among symptoms of inadequate feeding, that sleep is restless and disturbed. "A healthy infant after its appetite has been satisfied, goes to sleep usually at once and sleeps two or three hours quietly, or if awake, lies in placid contentment, exhibiting all the signs of physical well being. If, after being nursed it habitually wakes fifteen or twenty minutes after being put down, and rarely has a long sleep except from exhaustion, the food is insufficient in quantity or deficient in quality." Among symptoms of disturbed sleep, Holt gives first overfeeding or improper feeding. He states that in one-half the cases there is disturbance of the digestive organs. Chronic intestinal indigestion is a fruitful cause of insomnia. Acute gastro-intestinal diseases in infants often begin with restlessness, much crying and little sleep, while even that is momentary. In chronic digestive disturbances the children are restless, cross and irritable; they sleep badly and often have a dull and whining cry. Later, a dull apathetic state often supervenes.

Rachitis, noted by all writers as marked by the faulty nutrition which is present, shows as its most constant and early

symptom, extreme restlessness at night and sleep irregular and disturbed.

In older children, malnutrition is usually marked by disturbed and restless sleep. Night terrors might well be (and are, by some writers) put under the heading of digestive disorders, for they are so frequently initiated or intensified by improper feeding.

Insomnia, in its various phases, is closely related to the condition of the alimentary canal and the food habit of the individual. Sleeplessness of certain kinds yields only to properly administered food. Insomnia is a frequent and prominent symptom of neurasthenia and may be the first indication of trouble. Digestive disturbances in neurasthenia are early and marked symptoms.

MacFarlene gives as the two first causes of insomnia, neurasthenia and gout. The latter, as is well known, is characterized by digestive disturbances and resulting faulty metabolism.

Church and Peterson give hunger, overfeeding and indigestion as first causes of insomnia. Excessive brain work, as is well known, often induces both insomnia and indigestion. Intense intellectual work, on the other hand, when not carried to excess, actually whets the appetite. Tissot has noted that "he who thinks most, digests most."

Clinical experience everywhere has noted the intimate association of conditions of nutrition and the character of the ensuing sleep. From infancy to old age many disturbances of sleep are closely related with conditions of faulty or improper feeding, and tend to correct themselves just in proportion to the success in adjusting the diet to the individual need.

III. Review of Sleep and Rest Periods [1]

Logically, a résumé of sleep theories should precede the presentation of the sleep theory of the writer presented below. Lack of space, however, makes it desirable to do no more than briefly allude to some of the more prominent features of recent theories, and the excellent summaries of many writers make it fortunately unnecessary at this time.

Comparative habits of food taking in all species of animals, ranging from the amoeba to man, have been carefully studied

[1] A complete study of the relations of food and sleep will be published at a subsequent time upon the following lines:

(a) Insomnia and its relation to food taking.
(b) Sleep and food relations in general diseases.
(c) Sleep and food taking in the mental defective and insane.
(d) Comparative study of food taking and periods of rest and activity among animals.
(e) Hibernation, æstivation and food habits.
(f) Genesis of sense organs and oral cavity as related to food habits.

in order to determine the genetic factors common to all as regards periods of rest and activity.

The curve of intensity of human sleep is markedly like the practice or work curve of human activity, as observers everywhere have noted. The curve of recovery from fatigue on the part of the nerve cell, as demonstrated by Hodge, is similar to the curve of work and also to the curve of sleep.

The careful study of all species of animals has shown that periods of activity as the animals were feeding, are followed by periods of quiescence after the need of the animal is met, The period of quiescence varies with the development of the animal and much more with the character of food taken.

Continuous observation of *Amoeba proteus* (11), for a period of several days, resulted in the determination of definite periods of rest and activity, which bore a direct relation to the condition of satiety or hunger of the animal.

Studies by Loeb (12), of the lower organisms have called attention to the different response of the satisfied or hungry animal, as well as its greater activity when hungry.

Pearl's (16), admirable study of Planarians shows the relation of hungry animals to more marked activity; and further, he is strongly of the opinion that the periods of inactivity observed have a direct relation to the sleep periods of higher animals.

The long periods of abstinence from food on the part of cold-blooded animals is a matter of common knowledge. Activity in these animals is almost synonymous with hunger. Bostock, for instance, noted that his python was very active when hungry, and quiet for a long time after feeding.

Among warm-blooded animals the cat is an easy example to study. Hodge, in a series of observations of periods of rest and activity in the kitten, found the periods of rest were altogether determined by the amount of food available. The animal would sleep from sixteen to eighteen hours daily if well fed and only twelve or thirteen if sparingly supplied.

Periods of food taking in the herbivora are marked by constant wariness, which also influences their rest times. The elephant, for instance, is a tremendous eater and a very light sleeper; in captivity he has been found to sleep only four or five hours daily. While the elephant is the strongest animal known, it is evident his strength would avail him little, did he go off guard by sound sleeping.

Long periods of quiescence have been observed in many species of protozoa after periods of over abundance of food. Hibernation and aestivation as well take place in animals after

periods of abundance of food, in which the animal attains its highest physical condition.

The modification of the organism to the point of greatest adaptation to the food upon which it subsists, is well known. The earliest differentiation of an animal lies in the development of modified or increased sensitiveness at the oral pole. The groping of the sense organs in the higher animals, into the mass of nerve material forming the sensorium, of which the point of greatest sensitivity centers at and about the mouth, represents the highest development yet reached. The young of all animals, including man, are most sensitive at and in the oral region, and it is here that psychic traces are first suggested. It is pertinent that the first traces of consciousness should be exercised in the selection of food best adapted to the organism.

IV. Theory of the Genesis of Sleep

The problem of the genesis of sleep may be formulated thus:—

Why and how do organisms, from the least differentiated bit of protoplasm, through the complex of species to the highest differentiation present in man, form habits of alternation of periods of marked somatic and psychic activity with periods of absolute or relative quiescence?

In the early stages of this study, while discussing the subject of sleep with a prominent local physician who has given much thought to the care of infancy, the affirmation that to regulate the child's diet was to regulate the sleep, was dwelt upon. He continued, "a mother will consult you because the child does not sleep. That is the symptom that attracts attention and only because it is a source of so much annoyance. If you give the mother explicit directions in regard to the feeding, and if necessary, take time personally to show her how to prepare the food, the next time you see her you will be told that the child sleeps all right. There will be no further trouble if the care in feeding be kept up."

Studies of animal activity, from the amoeba upward, reveal periods of quiescence after ingestion of food, which periods in higher animals, differentiate into distinct sleeping and waking times.

Preyer and his disciples, President Hall, in his genetic psychology, and writers of many schools, have marked the great psychic activity connected with the nutritive function in the young child. The sucking reflex may be noted in the human infant as soon as the head is born, and may well be considered the first psychic response of the new individual to his en-

vironment. Taste and smell are present in the newborn, and it takes only a few days for the child to become habituated to the usual food, as is shown by the rejection of anything not prepared in the ordinary manner. Even the "feel" of a different nipple may cause marked difficulty in feeding.

Following this is the fact that the sensitiveness of the newborn child to stimuli is in direct proportion to its hunger. The focus of this sensitiveness is the mouth, and the response to stimuli decreases in direct proportion to the satisfaction of the hunger. When the infant is fed to repletion, he falls asleep at once and normally, in the early days, wakes only when the hunger again stimulates the organism, and then the demand for food is repeated with an intensity in direct ratio to the need of food and the vigor of the child.

Sidis (20), in his experimental work on hypnotic states, found he could not hypnotize a hungry infant. The child refused to sleep until fed, after which he was as docile as could be desired.

The dominance of hunger over the onset of sleep, the inability to take food after periods of prolonged physical and mental strain, until time for recovery has ensued,—(Manacéine's (15) dogs refused food the last forty-eight hours of life, when deprived of sleep),—the close association shown everywhere in the literature of sleep and nutritive conditions, all these mark the intimacy of the relation existing between the taking of food to supply potential energy and the building up of that food into available kinetic energy during the quiescence interval.

These facts, showing the common factor of food taking followed by quiescence throughout the animal series, together with psychic activity showing corresponding periods of activity and rest, have led to a survey of these inter-relations, and the following theory is presented as a provisional hypothesis in the synthetic attempt to correlate the widely divergent phenomena of sleep.

The theory is based on the phenomena of life as shown in periods of rest and activity alike common from the lowest organisms through various species to the most complex structures, with the resulting change from a simple to a complex environment.

The earliest manifestation of life is *irritability,* the property of being able to respond to external stimuli.

A corollary of this is the power to take in material from the environment and built it up into the organism, making it a part of itself. This property, developed is *assimilation.*

Given the minutest bit of least differentiated protoplasm,

the exercise of these two properties, irritability and assimilation, will result in proportional growth and differentiation. These so-called vital processes, the appropriation and ingestion of a part of the environment, the assimilation and subsequent increase in size and development, will go on fast or slow, according to the inherent elemental combinations forming the organism, and the character of the material taken in.

In other words, the vital capacity of the organism, and the character and amount of its food, whether large or small in potential energy, determines growth, differentiation and development, and includes reproduction.

The capture and ingestion of the food is an active process. The digestion and assimilation is a physiological process. The mechanical activity of the first stage is succeeded by the physio-chemical activity of the second stage.

In the lowest, least differentiated organisms, there is little perceptible difference between the outer and inner parts of the animal. The outer part responds to impressions of touch. The surface, physically and chemically, is different and more irritable from its position than the inside layer. When something comes into contact with the irritable outer surface, which is everywhere equally sensitive to touch, pseudopodia form and gradually enclose the particle.

Finally, from the cavity thus formed and maintained, the material is assimilated into the organism, and built up into its own structure. The two-fold function of the surface is thus seen to be the apprehension and retention of the food while it is being absorbed. Both these processes are active processes. After the food is absorbed, the work of the outside is done. The amount of food taken in has satisfied biochemical activity for the time, and the outer surface is inactive until, as a result of chemical and physical processes, it gradually returns to its earlier state of irritability.

During this period of outer indifference to stimuli, the inner protoplasm is appropriating such parts of the ingested material as its affinities have power to modify and assimilate. The result of this activity is increased potential energy which will later manifest itself in renewed activities of the organism.

The two-fold result of these changes is repair of structure and a storing of reserve material to be used as needed. The perfection of the anabolic processes depends on the proper external conditions of heat, amount of light and freedom from disturbance that is afforded by the environment.

It is evident that in an animal constantly in motion these changes will not go on in the same way as in a quiescent animal. The external surface of the animal when stimulated

may initiate changes in the organism's relation to the environment. Internal changes of certain kinds also depend upon external events. It is essential that internal and external changes balance in their anabolism and katabolism if the organism is to survive, while anabolism must predominate if growth and differentiation are to follow.

Here in this quiescent state of satisfaction and often satiation with food in the primitive organism is the first trace of the function of organic life which will later differentiate into well marked periods of sleep alternating with the distinctive activities which characterize waking life.

The fundamental functions of living matter are grouped about nutrition. The outer part of the organism develops from the simple undifferentiated surface of the primitive organism tbe complex centralized sensory-motor organs of man. The activity of an animal is concentrated on the part concerned at the moment in the ingestion of food. When an oral pole appears, it is the most sensitive part, while its sensitiveness is lost in proportion to the satisfaction or satiation of the animal with food. As soon as tentacles develop they are directly active in proportion to the satiated, satisfied, hungry or starved condition of the animal.

The human infant will respond to stimuli on the mouth and neighboring parts just in proportion to its condition of hunger at the time. Its head, arm and leg movements are as vigorous and energetic as any tentacle when it is hungry and as indifferent to stimuli when it is fully fed.

How can this similarity of changes in the sensitivity of outer surface, from protozoan to man, more logically be explained than by this direct association of hunger and the resulting satisfaction after food taking? When protozoan or infant is filled with food, there is nothing more for the outer surface of the one or the sensory motor organs of the other (which latter have primarily evolved for the better perception of and attainment of food) to do except rest, while the organism assimilates and constructs more and still more complex substances, resulting sometimes in more efficient food habits, and always providing more reserve material sources of energy for more food getting and for increased growth.

Man has been studied so exclusively from the point of view of his great differences from the animal world, that is, from his manifestations of mental activities so different from the predominance of vegetative functions in the lower animals, that the results of a comparative study of man on the same lines as the animal studies are often startling. Yet a close scrutiny of the nervous system of man reveals the re-

lationship clearly, with the same predominance of nutritive functions.

The organs of smell, sight, hearing, taste and feeling, are all developed in such ways that they can be most useful to the organism in its perception of and attainment of food. The sense of taste, by its location largely in the mobile tongue and its pharyngeal association with the vagus, is able to guard well the choice of food and reject that which is harmful.

The widespread distribution of the vagus, the motor nerve of the alimentary tract, makes possible all shades of modification in nutritive processes.

The greatest cortical area is that for the face, while the area for the arm is much greater than that for the leg. Muscular movements become more complex and accurate as the head is approached, and the extent of motor areas is correlated with the refinement of the movements which they control.

Besides cortical control over muscular activities and the special sense functions, the cortex is connected with the digestive tract in such ways that, while under ordinary conditions its influence is not in evidence, it may under certain circumstances markedly modify nutritive processes. Some observers have noted that stimulation of the cerebral cortex is followed by movements or relaxations of the walls of both small and large intestines.

Experiments (3) on animals show that, in conditions of general asthenia with intact nervous system connections, nothing is more responsive than the alimentary canal to cerebral stimuli.

In the asthenia of animals suffering with "distemper," food will lie in the stomach or intestines all day without a peristaltic wave passing over it, owing to the absence of motor activity. When the canal is separated from the brain and cord the stomach and bowels have been observed normally functioning, though the animal was exhausted and toneless to the last degree.

The intimate association of nutritive processes and mental function is easily understood if it be kept in mind that, as the organism has evolved, the activities of nutrition and growth, though obscured by complexity of structure and function, are still performed by the same relative part of the organism. It is still the function of the sensory-motor organs to capture food and get it into the organism.

The ingestion of food is as active a process in man as in an amoeba. Whenever undue strain of the sensory motor

mechanism is present, if normal connection of cortex and alimentary canal be intact, disturbances of ingestion and absorption are inevitable. These disturbances will act and interact on each other and the organism at large, and prevent normal assimilation and anabolism.

A further factor, fully as essential as those already mentioned, is that of a dangerous environment.

The twofold task of life is to get food and not become food. The statement, therefore, that the work of the outer surface is done when it gets food into the organism, needs modification. The secondary task of the outer surface of the organism is to give warning of danger and that quickly enough to afford escape. The initiation and direction of escape from danger is as much a part of outer surface function as is the perception of and ingestion of food; the animal will perish if the outer surface fail in either of these essential processes. The sense organs, therefore, can never be entirely oblivious to external events, but they must maintain a certain degree of activity, the level of which will be determined by the habitat and food habits of the animal.

From the latter fact, the evolution of the rest and sleep habits of an animal is seen at a glance. Quiet, dark, secluded places, free from disturbance, are sought for the twofold purpose of undisturbed assimilation and protection. Those animals which have succeeded in the two-fold process have survived. Those with intensest appropriation of food and keenest self-protective response have evolved into the higher complex surviving forms.

The sleep curve of man is full, on this view, of genetic history. The greatest height from one to one and one-half or two hours after the onset, while the cortex is at its highest level of nutritional activity, and the long, low, almost level line, just before waking, which lasts for many hours and during which the individual can be readily aroused, both alike suggest that *man has been obliged to build up, by most intense bio-chemical activity, quickly to such a level that he could avail himself of the greatest amount of potential activity,* after which he was able to perform the remaining task of assimilation with a low level of intensity, and yet be alert to escape from danger.

Much emphasis has always been placed on habits of going to sleep, and the necessity for seclusion from stimuli, the effect of monotonous repetition of sounds, the suggestion which comes from the sight of the sleeping rooms, sleeping arrangements, etc. Heubel (20), a Russian writer, experimenting on animals in relation to sleep and its accompanying

phenomena, has concluded that mental activity depends upon incoming peripheral sensory stimulation. When these are in abeyance or absent, mental activity lessens and sleep ensues. Sidis (20), in an experimental study of sleep, investigating hypnoidal phenomena in both animals and man, comes to the same conclusion.

The well known case of Strümpell's boy, who had only one eye and one ear which functioned, and was otherwise anaesthetic, is also often quoted as an example of the causation of sleep by exclusion of sensory stimuli, for the boy went to sleep when both eye and ear were covered. The accounts make very little of the fact that after a while the boy would wake spontaneously from his sleep.

The futility of careful exclusion of stimuli in cases of insomnia or even of over fatigue, is a matter of daily observation. The normal person, infant or adult, who has slept a sufficient time for psychic and somatic organs to be built up to their working condition, does not sleep in the absence of stimuli. He arouses himself and seeks stimuli. If he is detained by such conditions that exercise of body and sensory motor organs is impossible, it is only a matter of time on the one hand and of vitality on the other as to how soon actual disease and death will follow.

A factor not given due recognition when sleep is attributed to monotonous stimuli is, that any constant unvarying stimulus tends to psychic inertia as a result of the physical inertia. In medicine the effect of a monotonous, unvaried life is widely recognized as the cause of many psychic disorders and often of resulting somatic diseases as well. A condition of apathy is very apt to initiate the pathological deviations, in which indifference to food is an early and marked symptom usually obstinate to meet.

The logical conclusion of the above line of study is the following formulation of a genetic theory of sleep with resulting sleep habits:

I. *Sleep has arisen from the food habits of an organism.*

II. *The habits of food taking of an organism determine its periods of activity and repose.*

III. *The necessity for quiet and protection while the assimilation of food is taking place has led to the habits of seclusion on the part of the animal, both for the purpose of exclusion of outer stimuli and of safety from danger.*

Processes of growth and differentiation need periods of quiescence on the part of the animal, during which more complex structures having higher potential energy may be built up. Those organisms which live amid a plentiful continuous

supply of food and take it constantly have not evolved to the more complex functional level of the animals which having taken in a large amount of food remain quiet during its assimilation.

The succession of periods of rest and activity has resulted in better, that is, more labile organisms having resistance within themselves against too prodigal an expenditure of energy on the one hand, while on the other the capacity for physical activity of such character and intensity has developed that nutritive processes are completely overshadowed by other channels in which vital activity is occupied.

The discussion will not be complete, unless mention is made of habits of hibernation and aestivation. These are both regarded as manifestations of the protective instinct, although no adequate explanation of the origin or evolution of the habit has been given.

Both hibernation and aestivation take place invariably *after* periods of abundance of food. This time of great abundance tempts the animal on all sides and it eats freely and often, until it has reached its maximum of capacity both as regards food and growth. Cold weather following, lessens the food supply while quickly decreasing the temperature favorable for vital processes; both factors conduce to sleep. Those animals which have laid up within themselves the greatest supply of reserve nutriment will stand the best chance of surviving until food is again abundant.

The aestivation of tropical animals is due to the engorgment with food during the wet season. Those which find a favorable place during dry times are the ones which survive.

Close observation of animals supposed to be inflexibly hibernating in habit has shown a tendency in them not to do so if temperature and food conditions remain such that the usual daily routine of life is possible.

The mental condition of the human infant before birth has been the subject of much speculation. From an evolutionary standpoint, Ballantyne has pointed out that we can hardly consider the function of organs until the organism has reached the level of organic development. The central nervous system and special sense organs, while outlined in earliest embryonic life, cannot be regarded as functioning until a certain degree of development has been reached. Embryonic growth is accelerated at the fifth month and again in the sixth or seventh. The foetal movements are first felt by the mother in the fifth month, when size and muscular development have reached a sufficient degree. It is more than mere coincidence that the brain begins its increased growth at this time. The develop-

ment of the neuro-muscular system means the development of large areas in the sensory motor regions.

The movements of the foetus are more or less irregular, and no definite rhythm has been determined. Observation of foetal activity to determine if there be any periodic rhythm connected in any way with the food periods of the mother, are much needed here. Foetal movements are usually more active during the night. Whether this is altogether explained by the fact that the mother can give more attention to these movements at night, or whether an increased amount of nutritive material has been conveyed to the growing foetus at this time and so stimulated greater activity, is a matter for discussion and observation. At present, the data only admits of speculation.

It may be assumed that the nutrition of the growing foetus is continuous. Its growth and increasing activity as the sensory motor organs are developing call into play the motor elements of brain and cord. Touch is present before birth, and the primitive olfactory region is medullated before birth. Both activity and quiescence on the part of the foetus are well marked and form at least a psychic link in the genetic relationship of the new individual and mark his kinship to all organic life.

The periodic sleep of man is closely correlated with cerebral efficiency. Sleep, by developing long periods of inactivity on the part of the individual, during which assimilation can proceed to its highest efficiency, has furnished opportunity for sense development of such a character that only a limited amount of energy need be used for getting food, while the much larger part is at the disposal of the organism for improvement of the food conditions in the environment. Thus a higher development of the sensory motor organs will follow, better food will be assured, both of which will result in higher development of both psychic and somatic activity.

The final results are such that nutritional functions of the organism form a minor rôle in conscious life if the individual be in a favorable environment, and the major amount of available energy may be spent in ways more and more remote from the primitive function of food getting for the individual good.

Part IV. Psychophysiology of Sleep

I. The Length and Depth of Sleep

The amount of sleep needed by infants and young children is relatively the same, and both length and depth are in proportion to the maturity of the child. Ordinarily the first days after birth are spent in almost continuous sleep.

In a few weeks sleep should differentiate into regular times of waking and sleeping. These periods should consist of the long unbroken sleep during the night, and the intervals between the day feedings at first; later, waking daily periods will become longer, as the child develops mentally and physically. After early infancy, two or three long naps during the day are needed, while in late infancy, one long daily nap may suffice, though it is well to teach the child to take frequent periods of quietness even though he does not sleep. A judicious sprinkling in of five to fifteen minute periods of absolute quiet will go far toward cultivating a habit of conservation of energy as well as the prevention of the development of neurotic habits. Oppenheimer, discussing infant sleep, strikes the keynote of psychic development as he observes "an infant well trained in sleep is not only healthier and more amiable than he otherwise would be but is also more amenable to other forms of discipline."

Wachenheim (21) notes that seasonal variations may play an important rôle and less sleep be needed in summer than in winter. He states that a child of one year of age may do well on twelve hours in summer and need seventeen or eighteen in winter. Research on this aspect of the subject is greatly to be desired.

The depth of sleep has been studied by many independent investigators. Of these Czerny has an experimental study of the depth of sleep in infants, extending from birth to the second and third years. A secondary coil was used for an electric stimulus to determine the depth of sleep. In general, he found the younger the child the greater the strength of current necessary to produce perceptible reactions. The depth was greatest in the first hour, declined rapidly in the second hour, then more slowly, reaching its minimum in the fifth or sixth hour. He found a second slow rise in the early morning, always well marked, though never as intense as the initial rise. In breast-fed babies, particularly, Czerny noted the average duration of sleep to be about three hours, with only a single steep crest, similar to that of the older children.

Kohlschütter, in studying the depth of sleep, found the deepest sleep at the end of the first hour. The curve fell rapidly through the next half hour, then more slowly to the end of the second hour, after which it ran just above the waking line for several hours. Other investigators find slightly different curves of depth. In all these studies, sound was used as a means of determining the depth of sleep.

De Sanctis (19) and Neyroz, in a study of the intensity of sleep, in which the aesthesiometer was used as a means of

determination, found normally the greatest depth of sleep at the beginning of or in the first part of the second hour. While their results do not accord perfectly with results obtained by the use of the auditory stimulus, they do confirm what would naturally be expected, namely, that the different senses are not all equally off guard at the same time. The cortical areas would farther differ probably to some extent in the time of nutritive phase, depending on the conditions of fatigue in each separate sense organ and area.

One of the most important results of De Sanctis and Neyroz' study, however, was the discovery of great differences in intensity of sleep, as well as variations of the times of intensity, between normal and defective individuals. Mental defectives and insane persons showed marked deviations from the normal curves; their sleep was often much deeper, although the maximum depth coincided with the normal.

Many observers have commented on the resemblance of the curve of normal sleep to the curve of work. Professor Hodge's (10) nerve cell curve of recovery is also similar, in the quick onset of the nutritive phase and the slow after return to normal efficiency.

II. The Character of Sleep and Modifying Circumstances

All children are sensitive, in a measure, to any change in sleeping arrangements or caretaker; often changes result in decided disturbance or even marked loss of sleep. A few instances in the children under observation are typical.

No. 1, who rarely deviated from his periods of normal sleep, when six months old, was taken on a long railroad journey, remaining some weeks; while perfectly good-natured both ways, he cried in a most unaccountable way after each trip for two or three nights. Extra fatigue and the unwonted surroundings were the only apparent explanations.

No. 2, after company or being held more than usual, always had a fretful night's sleep and was inclined to be fretty the following day, with restless disturbed day sleep. In the early months of life, this child would stay alone with perfect content, and his sleep was much better when not disturbed by company. When three months old, he was taken to a new place, where it not only took a long time to get him to sleep, but the following day, though he had apparently slept well, he cried a good deal and was restless and excited. In fact this baby constantly showed during the early months of life disturbed sleep and fretfulness after being played with beyond a certain point. His later records show a disappearance of this fretty fatigue subsequent to being with strangers or extra play with relatives and friends.

No. 8 was very prone to sleep lightly and fitfully after seeing and being held by visitors.

No. 14 was accustomed to travel and see many new faces. She was always good natured and slept well, but many more hours than the average child of her age. In this way she undoubtedly compensated for the extra excitement.

No. 30, kept under absolutely uniform conditions until eight months old, was then taken on a trip to a neighboring city; she remained good natured through the entire trip and visit, but while no undue fatigue was noted, she slept much more than normally the following week.

Other records give similar reports; extra fatigue is compensated by extra sleep, and no illness follows.

Baldwin (1) found, as he assumed the care of his own child at night, that he had to learn as nearly as possible the nurse's procedure, in putting the child to bed. The nurse's personality was such an important factor that only gradually was he able to perfect his own method of inducing sleep. When the child resisted sleep, the simple procedure of holding her absolutely quiet was quickly followed by sleep. This method, combining "monotony, limitation of the voluntary movements and limitation of the field of consciousness," is the keynote of Sidis' (20) study of sleep.

The sleep of older children and of adults shows the same response of disturbed sleep in new surroundings. Traces of it also appear in animal life. When the evolution of the habitual sleeping place is recalled as a situation in which the satiated animal is safe during the time necessary for assimilation, then the uneasiness and often the inability to sleep in new or unfamiliar surroundings is better appreciated, for it is seen in its proper genetic background.

Normal sleep at any age is characterized by complete relaxation of the muscular system, the individual lying in an easy position. Breathing is regular and quiet, and slower than during waking activities. In fact the vital functions are all in a stage of assimilation, the intensity of which depends upon the different degrees of exhaustion each is in. The nutritive activity is naturally most intense in the nervous system, and here the phenomena characterizing sleep center.

Complete unconsciousness characterizes normal sleep, though evidence is abundant to show that certain events, as for example the passage of time, are marked under certain circumstances.[1] Special sense activity is at a standstill, and yet not altogether off guard. There are great individual differences as to which sense is easiest awakened, and thus, evidently, in a state of higher incipient activity. Touch, the mother sense, is perhaps most alert, and yet the distance senses of sight and sound are also easily aroused, and even smell may give warning of danger.

[1] Dreams, so prominent a feature in discussions of the psychology of sleep, will not be considered in this paper; but Sidis' (20) observation, "that we dream when we are awake, and not when we are asleep," appeals strongly to the writer.

III. Brain Growth and Development and Sleep

Psychologically normal sleep "consists in the suspension of conscious processes during the stage of nutritive activities of the central nervous system." The sleep of normal adults results in the repair of nervous tissues and is followed by increased intensity of all nutritive processes, quick, easy and accurate muscular coördination, and increased acuteness of all the special senses.

Infant sleep differs from adult in that the nervous processes are not only those of renewed metabolism; in infancy the brain is growing at a phenomenal rate, and *habit formation is inseparably bound up with growth and development. The infant brain has three essential things to do, namely: to grow, to learn to function aright, and to establish habits which will be most efficient in the rhythm of work and rest.*

Using Donaldson's (7) figures of brain growth, the initial brain weight at birth of 381 grams increases to 945 grams by the end of the first year, a gain of 145%, while at the end of the fifth year the weight is 1263 grams, a gain of nearly 232%.

This fact alone means that infant sleep is a much larger factor in laying the foundations of health, character, and fitness for future usefulness than has been appreciated. If the new citizen is to be successful in the game of life, he must first be equipped with ability to easily and readily adapt himself to his environment, which implies the power of quick, instinctive effectual action on the one hand, and on the other, the power of controlled response of adapted inhibition.

The child at birth is a very unfinished product, possessing hereditary capital, but dependent on his environment for the development and conservation of this capital. Each thing done for the child directly educates the organism, and the responses, random as they are at first, may yet be set in their manner of reaction during the first twenty-four hours after birth.

An analysis of Flechsig's (8 and 18) studies of brain development in this connection is perhaps the quickest method of grasping the extreme plasticity of the brain in infancy. The stage of medullation, marking the beginning of function, begins four months before birth; and four months after birth every part of the brain has some medullated fibres, and the main paths are then already laid. Flechsig divides the cortex into thirty-six areas, of which twelve only are medullated before birth. The primary sensory motor areas representing smell, touch, muscle sense, sight, hearing and taste are all developed before birth. The olfactory area begins its medul-

lation first and is followed by medullation in the great sensory motor areas of touch and muscle sense for the entire body. One part of this area contains sensory nerve endings found nowhere else, while another region contains characteristic giant pyramidal fibres giving rise to voluntary action.

The groups of association centers develop as border zones around each primary sensory area *after birth;* the earlier sensory areas in general develop earlier border zones; and later the motor fibres, commisural fibres and association fibres which connect all parts of the cortex, become medullated. The three great association centers develop last, and develop in the center of whole groups of border zones, instead of in direct relation to any one of the primary zones.

One cannot but appreciate, in poring over these facts, how entirely the great opportunity for molding and directing, and so conditioning not only individual but racial development, is in the hands of those who are in charge of the child at this time.

Anatomical and physiological conditions alike are plastic to a greater degree than at any subsequent time. It is evident that the influences acting upon the child are constructive or destructive to it from the first moment of extra uterine existence. Each day increases the activity of developing visual, auditory, olfactory, gustatory and tactual tracts, while the central motor regions are most active in growth. Poor nutrition retards this growth, which, though it may be made up later, may yet lack the advantage of earlier growth.

Nowhere else as in the brain at this time is the interdependence of structure and function more strikingly shown. There is a bewildering influx of all kinds of stimuli on the one hand, and on the other the rapid growth of the brain; and nature has left both accessible to adaptation that the perfect structure essential for success in the struggle for existence may be shaped by actual functioning.

Fundamental association paths are to be laid between the different primary areas, connecting these with each other and with each part of the extensive sensory motor regions. These association tracts ought to be those leading to increased stability of structure, and to inhibition of movements unnecessary or destructive in their nature. The central aim in the care of earliest infancy should be the establishment of stable, well-balanced centers. The child with an exceptional capital of good heredity may well be given a start that will aid him in advancing his race. The child with an average capital may easily be given an impetus that helps him to advance far beyond his fellows. For the child with a parentage of

lowered nervous capital, here at the threshold of life, even during the first twenty-four hours, is the time and place to begin the correction of potentialities before they have blazed harmful tracts in the virgin cerebral wilderness.

The earliest need of the newborn child is rest, absolute, while birth fatigue is being met. In a weak child there may be a demand for very early, intelligently administered nourishment if the child is to survive.

Normal sleep in the early months of life is a purely involuntary process. Undue fatigue, from any cause whatsoever, is followed by marked disturbances and often by loss of sleep. A healthy child should have several hours of continuous sleep at night. In the early months of life it needs many periods of quiet sleep during the day. It should be fed in such a manner that both growth and good sleep follow. The rhythm of its needs varies. One day it may be over fatigued from too many stimuli, another day it may have been alone and can, therefore, take and assimilate more food than when it is unduly fatigued.

As the child grows older psychic events have all degrees of influence on sleep and must be taken into account. The emotional tone is gradually forming and every effort must be made to exclude undue excitement.

From the second to the sixth month vision, hearing and muscular coördination are taking great strides. The second six months mark the creeping period and the beginning of walking, the third six months should establish the ability to walk; speech is also beginning in earnest and takes great leaps in the following year. In all these activities the brain centers concerned with each function are rapidly growing and forming their habits of coördinated activity. Should any abnormality appear, this is the time to remedy it where possible, before a manner or habit of reaction is formed.

The increase in size and complexity of the neuro-muscular system is furnishing power of coördination and the ability to profit by experience. Great demands are being made upon both heredity and acquired capital. The emotional tone is in a formative stage and judicious safeguarding of sleep will go far toward establishing habits of inhibition and reflection. Any abnormal manifestation must be regarded as a danger signal and the child unceasingly taught to adapt response to stimuli. Judicious, constant, untiring hygiene of sleep in these early days will bring the well-earned reward of a child skilled in self-control and adaptation.

Stimuli are essential for normal development. Bose (2) goes so far as to call them "sources of energy." Verworn

includes under stimulus, every change in the external condition of an organism. Wilson notes that normal development is in a greater or less degree the response of the developing organism to normal conditions, while the character of the response is determined, not by the stimulus, but by the inherited organism. Lloyd Morgan urges that the primary aim, object and end of consciousness is control, while Angell emphasizes the adjustive function of consciousness.

It is evident that stimuli of all kinds must be thoughtfully and intelligently applied to the child's needs. A husky or a phlegmatic youngster can and does thrive on what would be disastrous to a timid shrinking child. The character of sleep following stimuli is the criterion of adaptation of care to need. If the ensuing sleep be quiet and the waking good natured, only good has resulted.

Relation of the Emotions and Sleep

At the beginning of life emotional activity is in the potential stage, and its manifestation has solely an instinctive character. The passing over of the reflex into the dawning conscious activity of emotional response normally occurs so early in life that before the fact is realized the general emotional tone may be definitely established.

The pleasure-pain reflex is earliest stimulated. In the cleansing of the mouth during birth, as soon as the head is born, in a normal delivery, the effort of the child in sucking whatever is introduced into the mouth, certainly is strongly suggestive of an organism free from discomfort, and capable of physical gratification incident to nutrition. Many infants take up breathing with hardly a gasp before normal respiration is instituted. Such children sleep quietly as soon as the birth toilet is completed, and go on sleeping and growing, with the mental pleasure manifestation gradually evolving from the physical well being.

Fear, first shown as an instinctive reaction, is also one of the first emotions definitely shown. Its earliest physical manifestation is the fear of falling, and even the sturdiest child will show it if support be not adequately given in the handling of the child. In the hands of an unskillful or careless nurse, the habit of fear may be initiated in this way, and lead to the development of all varieties of neuroses. When fear is present on waking from sleep, the sleep has probably been deficient in quantity or quality, if the child is normal. Undue fear at any age means a defect somewhere in the organism.

A neurotic child has much to contend with from a habit of fear, and judicious increase of all conditions favoring sleep

will be the parents' most efficient weapon of defense. The attitude, "I'm afraid," ought to be combated as assiduously as would an acute infectious disease, and effort be made untiringly to prevent its development. President Hall's study of fear shows how widespread and deep this "habit of fear" may become. When one child enumerates fifty-seven fears, the inference seems justified that the *anlage* of that child is laid in most unstable protoplasm. While fear is essential as one facet of a well developed personality, the tendency of the day is such that a well rounded personality, with fear in its proper background position, is far too uncommon.

In early childhood "night terrors" are common in the delicate child. Psychical causes are responsible for its occurrence in a certain proportion of cases. Even a normal child, after an intense fright or great excitement, may have an attack which sometimes reveals an unsuspected weakness in the organism. Fear is always a cause of disturbed, restless sleep, and often of wakefulness. In a child a little older, worry, which might be called incipient fear, may lead to sleeplessness. Worry at any age is likely to be a precursor of severe disturbance.

Mosso, in his classic study of fear, says: "The one who brings up a child represents its brain. Every ugly thing told a child, every shock, every fright given him, will remain like minute splinters in the flesh, to torture him all his life." * * * "Anxiety, fear, horror, will twine themselves perpetually around the memory." * * * "Not only the nurse, the mother, or the maid, or the servants, but hundreds of generations have worked to denaturalize the brains of children with the same barbarity as those wild tribes who distort the heads of their children by pressure."

The effect psychologically of normal sleep is that of a feeling of well being, "euphoria," of abundance of life with joy in the privilege of living. Good nature, the ability to take a humorous view of difficulties, the desire for work (Loeb's "instinct of workmanship"), prodigality in expenditure, and the ability to renew in yet fuller measure, all these and all that make for intense mental work are the immediate results of normal sleep in the normal individual.

The one quality of good nature,—the writer feels strongly,—is a most valuable index of the character of sleep, and further, of well being. No one has any right to be ill-natured, either in the home or in society. It is a matter of common observation in infancy and childhood that insufficient sleep is productive of ill-nature. Analyzing this physiologically, it is seen that the individual is irritable beyond the point of

easy control, while a psychological analysis shows that the response to stimuli is above the point of conservative adaptation to the environment. Both facts indicate that the organism has not built itself up to the condition of stable, much less, of reserve equilibrium, from which it can control and conserve its forces. The level of normal control varies with individual, age, and circumstance, being much higher in a phlegmatic person than in an individual of the so-called "nervous type."

From a psycho-physiological point good nature means that the reserve capacity of the individual is large enough to permit lavish expenditure of energy. When the struggle for survival is strong, the strife of all against all leaves neither opportunity nor inclination for mutual, much less, for one-sided aid; but when abundance of material has built up abundance of life, then the brain can advantageously control the environmental forces for social and racial advancement.

The subject of fatigue has been extensively investigated from many standpoints. A certain amount is necessary for successful sleep, while either over or under fatigue is productive of wakefulness. The ability of recuperation after fatigue varies under many complex laws, which in a final analysis reveal the fact that the fundamental factor is the amount of life, vitality, possessed by the individual, with which he can initiate reconstruction processes and carry them to a successful ending. In extreme fatigue disease and even death have followed. In ordinary fatigue the mental processes are much inferior to the output in a rested state; and the whole personality may be very different in the rested or fatigued condition.

In the final analysis, personality or character is merely the unification of psycho-physiological processes in the individual. The emotional tone may shape, dominate, or modify the so-called intellectual life; however, a well balanced adjustment of both intellectual and emotional elements makes for survival and advancement more than does the predominance of either.

The hereditary capital a person starts with is beyond his control, and the adaptation of what he has to his own needs is in the hands of all who care for him during the formative periods. While it is self-evident that there are individual differences present at birth which are not amenable to any form of treatment, it is imperative that no effort should be spared to make the new individual an efficient worker in the community and to teach him that a parasitic existence is deplorable from any point of view.

Often, after the initial performance of an act many hours

may be needed for recuperation. A second doing the same thing may be followed by marked diminution in the time needed for recovery. The parent who teaches his child efficient rest and sleep habits gives him the next best thing to a good hereditary capital. The possession of such habits will be a lever with which the fortunate individual can indeed move the world.

The first and greatest need of infant life is food, the next need, fully as important, is time for assimilation of the food and absence of stimuli while the complex brain is building up to perfect functional capacity. After this, the need is imperative for the judicious play of stimuli in such a manner that inhibition is promoted, response regulated to the stimulus given, muscle reaction and nerve impulse coördinated until the growing organism reaches its perfection of adapted controlled response to stimuli. It is a question of outer abundance and of ability for use by the organism, and the evolution of sleep has been the method by which the species have utilized environment for the perfection of structure.

Safeguarding infant sleep and the furthering of everything conducing to its normal occurrence, offer our most efficient allies for combating bad heredity, for conserving and building up the race, and conduce to efficient utilization of good hereditary capital in the child.

Summary

The vast importance, its biological aspect as one feature of the universal organic rhythms of activity and repose, the far-reaching ramifications of the subject of sleep, make this present study, although complete in a way, really a preliminary survey of various features of the problem. The research will be continued on the lines of the problems suggested in the course of the study, while all dogmatic assumptions will be withheld until sufficient data warrant conclusions.

An evolutionary study of sleep should include:—

1. Numerous records of the character, intensity and length of sleep in infancy, childhood and adult life.
2. Conditions of food taking, state of nutrition, etc., as related to coincident sleep.
3. Correlation of physical and mental work and sleep.
4. Correlation of 1, 2, and 3, with each other and with coincident weather conditions.
5. On the above lines, comparative studies of animal periods of activity and repose, and careful consideration of periods of growth of plant life in the varied aspects.

To make the study complete, so-called inorganic rhythms

should be fully investigated, and if proven their relation to organic activities ascertained.

Bio-chemistry, studying the modifications of elemental characteristics when acted upon by vital forces, will, when the chapters are complete, give us the solution of the problem: *How* periods of mass activity and mass quiescence alternate. *Why* the alternation, may be answered tentatively to the effect that organic life thus far has developed most successfully on those lines. One is tempted to speculate as to lines of modification such that uninterrupted mass activity would be possible with molecular activity of sufficient intensity and the effect of this upon the human life and activity.

The results of this study may be summarized as follows:—

1. A method has been formulated by which observations of the conditions of sleep in childhood may be easily and accurately recorded.

2. No correlation between the length and quality of sleep and changes in barometer and humidity is shown. Usually a child's curve of sleep rises with rise in barometer and humidity a certain number of times, and falls with rise in barometer and humidity an equal number of times; and so, in general, the changes of both curves indicate negative results, but occasionally an individual is found who is clearly affected in marked degree, at least at certain times, by such changes.

3. This investigation puts added emphasis on the well-known fact that the sleep of the normal infant is dependent, to a marked degree, upon the adaptation of food to his individual need. The first symptom of inadequate feeding shows in disturbances of sleep.

4. The intimate relation of the adaptation of food to normal sleep in infancy, and the fact that through the animal series periods of activity incident to food ingestion are followed by periods of quiet during assimilation, has led to the formulation of the following theory of sleep:—

a. The character of an animal's food determines its periods of activity and rest.

b. Sleep in the higher animals and man has differentiated from the periods of quiescence shown in the lower animals after ingestion of food.

c. The necessity for quiet and protection while assimilation is taking place has led to the selection of secluded spots by the animal at such times. From this has risen the elaborate sleeping arrangements by which the higher animals and especially man exclude stimuli and secure conditions most favorable for assimilation.

The following practical points are especially emphasized by this preliminary study:

I. The great need of accurate and trained oversight of the child during the period of infancy. Records of weight, height and facts relating to growth should be carefully noted daily and weekly. These factors should be coördinated with the conditions and results of sleep.

II. The necessity for careful study of the child in regard to its behavior under changing weather conditions. This present study shows frequent fluctuation of the length and often of the character of sleep coinciding with changing weather. Each child ought to receive special care at times when weather occurs liable to cause impairment of sleep or make him irritable.

III. The paramount importance of the inter-dependence of food taking, the resulting state of nutrition and the character and length of ensuing sleep. Brain growth and development depend upon the successful coördination of these factors more than upon anything else.

IV. The physiological and psychological advance of the individual and the race depend fundamentally upon the manner in which the infant is able to sleep. *Parent and caretaker here are directly responsible to the child and to the community for the safe-guarding of infant sleep, and also for the formation of efficient habits of sleep.*

The sleep of the infant is a part of the great organic rhythms of activity and repose. Throughout nature, wherever vital forces are at work, periods of molecular energy result in the formation of masses, with corresponding periods of mass energy. Manifestation of mass energy is always followed by periods of mass quiescence, during which the mass is again built up to all degrees of unstable equilibrium.

We need norms in every department of infant life, before we can accurately determine whether deviation from the normal is present. The physiology of infancy requires careful, accurate study to determine what criterion we may use in our choice of particular lines of care. Infant life is plastic in the extreme and it is fully time that the community as well as the individual be taught that not ordinary care but extraordinary care is imperative if individual and racial advancement is to become a possibility.

The essential feature of the problem of sleep is the need of the correlation of sleep with activity, first in infancy, where we have far too little accurate data, and second, in childhood and adult life, where the need is fully as imperative. There is no doubt in the mind of the writer that careful accurate

observation of different animal rhythms of activity and repose can and will offer many valuable suggestions as how best to coördinate sleep and rest with activity and work.

The ultimate practical problem is, How to instruct each individual in such a manner of living that he may best regulate and utilize his periods of activity and repose for the greatest efficiency.

Grateful acknowledgment is made at this time to all who have assisted in this study. Many mothers have faithfully and patiently kept records for long periods of time, and to them, primarily, the study owes much. Professor C. F. Hodge, at whose suggestion the study was undertaken, has given most valuable aid with helpful guidance and constant fertility of suggestion. Dr. L. N. Wilson and his assistants in the library have made a wide survey of the literature possible, while many members of the University have given helpful criticism and suggestion. To all these cordial appreciation is expressed.

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ARITHMETIC AND REASONING IN CHILDREN

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What is the capacity of the normal child for the higher thought processes,— abstraction, generalization, reasoning? Do these processes exist in children at all, or is the child mind too much absorbed in the acquisition of a mass of experience to admit of the existence of other activity? And if they do exist, can we devise experiments which will adequately reveal them? Are they sufficiently fundamental to justify an endeavor to formulate tests which will serve to measure them in children of widely different environments, and to establish age norms? Closely bound up with reasoning is arithmetical activity. What is the product of the schools in arithmetic? Is it uniform, or variable? If the latter, what is the relation between school conditions,—supervision, courses of study, expenditure of time,—and the proficiency of the pupils in arithmetic? Is arithmetical ability a single ability, or a complex of many different ones? If the latter, what relations obtain between the constituent capacities?

These questions, along with a host of others of educational import, have loomed large in pedagogical controversy since the days of Comenius; it is only within the last decade or so that their serious experimental investigation, in any modern sense of the words, has been attempted. Previous to this period, opinions regarding reasoning agreed in the fundamental assumption that the child's body of knowledge is exceedingly limited; they differed in the matter of emphasis, some stressing the child's efforts to adjust sense data, and finding therein all the essentials of reasoning, others maintaining that the extreme poverty of the child's mind renders impossible, until a comparatively late stage, anything like logical formation of conclusions. Some hold that the capacity for purposive thinking is educable, and deplore the failure of the teaching in the schools to stimulate original observation and sound thought based on that observation (C. A. Scott, 31 and 32; Hancock, 14; Bolton and Haskell, *Ed. Rev.* 15, pp. 473-499); while F. C. Sharp (*Ed. Rev.* 1893) goes so far as to recommend special courses in reasoning, to extend throughout the schools, and to be given by teachers trained for that purpose. Such courses would be based on

the facts learned during the progress of other studies of the curriculum. Regarding the value of arithmetic there has existed a similar conflict of views, as Dr. Burnham points out (6). Opposed to the exaggerated reverence for mathematics, due to its alleged value for formal discipline, were Schopenhauer (1788-1860), who called mathematics the lowest form of mental activity; Holmes, who regarded mathematical thought as a mere calculating grind; Huxley; and most vehemently of all, Sir William Hamilton (1836), with his sweeping denunciations,—"Mathematical study is inferior as a builder of mind; devotion to it is fatal to the development of sensibilities and imagination; continued pursuit of it leaves the mind narrow and dry, meagre and lean." He admits, however, that study of mathematics may check the habit of mental distraction, and form that of continuous attention. Bledsoe (1877), editor of the *Southern Educational Review,* and later, Pringsheim, accuse Hamilton of deliberately misrepresenting the authorities whom he cites in support of his opinions. Peterson (26) also takes issue with Hamilton, maintaining that arithmetic, with its combinations of numerical properties and its demand for reasoning, is highly beneficial to the child, for the very reasons that Hamilton names. Keyser (17), himself a professor of mathematics, dwells enthusiastically on the value of mathematics, the beauty of its deduction from a score of premises,—a few logical constants,—its appeal to the whole mind; he points out that both Schopenhauer and Hamilton were ignorant of the subject they condemned, the latter even proudly so. Something of Hamilton's attitude is adopted, on the other hand, by General Francis A. Walker (36) in an address before the Boston School Committee in 1887. It is well, he says, to decrease the time spent in mathematics in the public schools if this can be done without injury; number-work is important, but let us restrict arithmetic to it, and devote the time now spent in the more logical aspects of arithmetic to certain other studies, equally fitted for the cultivation of powers of observation and generalization. The whole conflict seems to hinge on the question of whether arithmetic consists merely in numerical operations, or whether it includes the application of logical principles. Schopenhauer, Huxley, Hamilton and Knilling, taking the first-named position, find arithmetic mechanical and narrowing; Keyser, with the latter viewpoint, exclaims over its breadth. Walker (36) and Padoa (25) also distinguish between number and logic, and confine arithmetic strictly to the former.

A long line of German investigators, taking their cue from

Pestalozzi,—*Anschauungslehre der Zählenverhältnisse,* 1804, —have studied the genesis of the number concept with a view toward devising improved methods of teaching the simple arithmetical operations. The result has been a perennial crop of number-picture charts, and various intricate pedagogical devices, based very largely on the adult consciousness of number, but very slightly on the results of study of the effects of different methods on the learning time of the child. Regarding these it is sufficient to mention two main points of view, that represented by Lay, Messenger, Nanu, Göbelbecker, Walsemann, and others, that the idea of number is a product of direct perception; and that of Dietze, Knilling, Boehme, Kehr, Hartmann, and others, who maintain that the number concept is a product of the act of counting. Good reviews and bibliographies of this literature are given by Meumann (23) and Schanoff (30).

We come now to the experimental studies which bear upon the present topic. Brown (3), Ellison (11), and Eckhardt (9) have made investigations of the thoughts and number ideas of young children. Brown examined the collection of children's sayings gathered by the Worcester State Normal School, and selected and classified 375 of what he deemed the most significant ones. Some of his rubrics are 'misunderstandings of words,' 'misapplications of sayings,' 'explanations of things,' 'false reasonings.' He was much impressed by the children's lack of understanding, due to the "difficulty under which the child labors in trying to deal with the overwhelming multitude of objects and events in the midst of which he finds himself." Yet the child often shows surprising aptness in theorizing; the inadequacy of his theories are due to their being based on false or insufficient data.

Ellison, on the basis of 12,000 definitions of common abstract terms obtained from children of St. Louis schools who ranged in age from eight to fifteen, arrived at a similar conclusion. She found that such mastery of common abstract ideas and of language as would make possible reasonably perfect definitions is lacking in children of thirteen and under, though for several years before this time the abstractions have been clearly enough grasped and the vocabularies of the children large enough to admit of definitions by synonyms. Still earlier, children hold the idea in concrete form, and express it by examples.

Eckhardt gives the results of a statistical study of the number concepts of children upon entering school, and appends figures showing later stages of the development of such

concepts. The method of his investigation consisted in asking the children (45 in number) to count as far as they could; to count by twos, fives, sixes, sevens, and eights; to begin with a certain number and subtract by ones, twos, etc.; to read numbers; and to tell which of two numbers is the higher. His results are given in a single table; no attempt is made to interpret these data by the ordinary methods, and the labor of deciphering them is thus considerable. In so far as we understand his findings they seem to justify the following general statements: Children possess fairly well-developed ideas of number at the age when they ordinarily enter school. His subjects were able to count up to from 3 to 1000; the median number counted was 100 (24 cases). Those who could count to 1000 could also count by twos, threes, etc., and subtract by ones, twos, etc. For most, adding and subtracting by higher numbers was difficult; 4 failed in adding (counting) by twos, and 31 in adding by fives, sixes, sevens, or eights, while the corresponding numbers for subtraction were 10 and 35. In subtracting by ones, some found it necessary to count from the beginning of the series to the number just before that from which 1 was to be subtracted. In the tests for ability to indicate the greater of two numbers, 2 failed; all of those who could count up to 1000, and 10 of those who could count to 100, succeeded. Some could make the distinction within tens,—thus, 47 was known to be greater than 42, but there was doubt about 47 and 22, or 42 and 27. Twelve were unable to read numbers; 6 could read them up to 1000. The children who could count up to the greatest number almost invariably showed the highest school grades.

The remainder of the experimental investigations considered here may be arranged for convenience in three divisions: (1) Those in which the main emphasis is placed on the reasoning, or purposive association, of children; (2) those which have as their object the measuring of the arithmetical ability of children, in its relation to the courses of study and methods of teaching in the schools; and (3) those which have to do chiefly with the relations between different arithmetical operations. There is inevitably more or less overlapping between the different groups, as each contains studies which treat in a minor way of matters properly belonging to another group; but the main distinctions are evident.

1. *Studies of Reasoning in Children.*—Hancock, in 1896, perceiving a general dissatisfaction with the results of arithmetic teaching, due to the fact that children who do well one year often fail the next, undertook to throw light on the actual development of the power of reasoning in children,

knowledge of which is essential, he thinks, before improved methods of teaching can be devised. His method consisted in the presentation of syllabi to the child study section of the Colorado State Teachers' Association, asking them to submit certain tests to their pupils. Four series of tests were used, the first series being presented to the first three grades, and the other three series to the fourth and following grades. The tests consisted in simple arithmetical problems, dealing with small numbers so as to minimize the chances of mechanical errors; each was short enough to obviate any fatigue element. The third series was designed particularly to test pupils' ability to deal with conditions somewhat algebraic; the fourth to test their power to visualize conditions. A sample problem from the last is the following: 'Two boats, starting from the same place, sail up river, one at the rate of two, and the other of three, miles per hour; how far apart will they be at the end of four hours?' The ages of the children tested ranged from seven to fifteen years inclusive.

The results are given in terms of the percentage of pupils who succeeded in solving each problem. The main findings are as follows: for the first two series, confusion in analysis of problems is common; children guess at methods. There is loss of power by girls of ten and boys of eight and fourteen, which loss is compensated for later. The percentage of error decreases most rapidly at nine, thirteen, and fifteen years. As regards the fourth and fifth series, the boys excel in the former, and the girls in the latter. "This agrees with Galton's finding, that women visualize better than men." Hancock's conclusions are as follows: if there are periods when a power begins to develop and function, and forcing it to function before its time is provocative of later weakness, the question of what modifications are needed in the arithmetic course becomes an important one. The large percentage of error found in earlier years suggests that the time for such problems as are contained in the tests is later. Early introduction of algebra and geometry is desirable; more time should be given to arithmetic at the ages of nine and thirteen. It appears that children do not reason far beyond their environment and experience; early training should utilize and extend these two factors.

King (18) was the next investigator along this line. His problem was to throw light on the development of thinking power in children. His procedure consisted in sending tests to teachers in the public schools of various parts of England, to be given to their pupils. The tests were divided into three series, the first to be given to children of from seven to ten,

the second to those of from ten to twelve, and the third to those of from twelve to thirteen. Each series contained two questions, of which the following is typical: " There are several clever boys in a class, and all are careless; therefore a clever boy must be a careless boy. Do you agree?" The last question of each test was identical with the first of the succeeding test, this to permit comparison of stages of growth. Returns were received from 2000 children. The results were as follows: The percentages of pupils answering each question correctly were, for test 1, question 1, 13.1, question 2, 9.4; for test 2, question 1, 20.7, question 2, 30.0; for test 3, question 1, 44.4, question 2, 56.4. Thus there was progress with age. Many glimmerings of solutions,—non-agreement without reasons,—appeared. The girls were more verbose than the boys, but there was little difference in efficiency. Many pupils of fifteen who had received good education showed only the merest germs of logical thinking. Education improves the reasoning capacity. King believes that a more satisfactory, though severer, test would consist in questions further removed from the pupils' experience.

In 1903 J. H. Bair (1), of the Department of Psychology and Education of the University of Colorado, published the results of a study in which an attempt was made to measure the reasoning power of children of different school grades, so as to determine the rate of its development. Two questions were given the children of the public schools of Boulder, Colo. They were (1) " A boy said, ' I know ten doctors who were all good, and ten policemen who were all bad. Therefore doctors are better men than policemen.' Was he right, or wrong? Give reasons for your answer;" and (2) " Mr. Roosevelt said, ' There were thirty boys who were all hard students and were promoted every term. Therefore if you wish to become rich, study hard.' Was he right, or wrong? Give reasons." Bair's results showed a fairly uniform progress throughout the grades. Wide individual variations appeared. Many of the poorer replies showed bias, *argumentum ad hominum,* and lack of ability to understand what was wanted or to use facts. Bair concludes that school curricula do not sufficiently take into account differences in children's power of thinking; moreover, the material given pupils often involves factors beyond the scope of their experience. The reason that children fail in constructive power is not that their capacity for logical thought is immature, but that they lack the information without which it cannot function.

The results of these three studies agree in showing a general progress in ability with age, and striking weaknesses,

especially in younger children. Like most pioneer studies, their value lies in suggestion rather than accomplishment; for certain inadequacies in the work are very clear. We are uninformed regarding many important details of procedure; the possibility of determining grade differences by comparison of the returns of different tests is very doubtful; and treatment of results is incomplete.

Bonser (2), the next and by far the most thorough investigator in this field,[1] removes, in his study, many of the sources of error in previous work. His problem is "to secure concrete basis for some insight into the capacity of children of the fourth, fifth, and sixth school grades for reasoning. His method was essentially the test method of previous investigators. The tests, seven in number, were divided into four series, entitled respectively *mathematical judgment, controlled associations, selective judgment,* and *literary interpretation.* The tests in mathematical judgment consisted in simple arithmetical problems, such as are found in text-books of arithmetic, part of them, however, being stated in a less conventional way. Those in controlled associations consisted of two sets of sentences, in the first of which a significant work was omitted in each case, to be filled in by the pupil (*i. e.,* A ———— is one who plays a musical instrument), and in the second of which a choice of two suggested significant words, one suitable and the other not, was given (*i. e.,* Glass breaks more (less) easily than tin); also in a list of sixty words, of each of which the pupil was asked to write the opposite. The tests in selective judgment contained two series, the first consisting in a number of statements, with ten reasons for the truth of each statement, some of the reasons correct, others incorrect or irrelevant, the pupil's task being to select the former; and the second consisting in a number of terms, each of which was defined in five different ways, some correct, others incorrect, the pupils being asked to indicate the correct definitions. The tests in literary interpretation contained stanzas of poetry, from the second and third readers, the pupil being asked to write the essential content of each stanza in his own words. All tests were printed on sheets of paper, spaces being left for the pupil's work where necessary.

Bonser discusses the question of what ability it is that his tests really measure. Reasoning, he says, is purposive thinking. It involves: the recognition, in any situation, of previously unnoticed resemblances or common elements, implying an analysis of that situation; the 'guess' that the observed relationship is universal under similar conditions; and

[1] Consideration of the Binet tests is omitted in the present paper.

the verification of this 'guess,' or hypothesis, by testing it under such conditions. Up to and including the formation of the hypothesis, the reasoning is inductive; afterwards it is deductive. Capacity for deductive reasoning, Bonser thinks, is what is measured by the tests; the pupil must select and apply an appropriate principle or hypothesis from those which suggest themselves from his previous experience. Thus, in the tests of mathematical judgment, he must analyze out the essential features of the problem, and from among the principles which he can recall he must choose one that is identical with that of the problem; similarly, the tests in controlled association and selective judgment demand accuracy in recognition of resemblances between the known of experience and the unknown of new situations; and in the test of literary interpretation the child is asked to abstract, to evaluate, and finally to synthetize, the essential thought units.

The subjects in the experiment were 757 children, 385 boys and 372 girls, pupils of the grades named in five schools of Passaic, N. J. The sex distribution throughout the grades was remarkably even; the numbers of children in each grade varied from 109 to 181; ages varied from eleven years seven months to twelve years three months.

Bonser himself gave all the tests, being assisted on two occasions by two graduate students of Columbia University. A time limit of two minutes was set for the opposites test; in all others, the work was collected upon the completion of the first paper. The scoring was done according to rigid objective standards in all cases except that of the tests of literary interpretation, where the reconstructed poems were graded on a basis of their estimated merit.

The main results are given in the following tables:

1. Median ability and variability for each grade, in terms of actual scores made. (Highest possible score, 265.)

	Medians		Higher		Quartiles of Variation	
Grade	*boys*	*girls*	*boys*	*girls*	*boys*	*girls*
4A	117.50	130.00		12.50	34.01	22.08
5B	155.62	146.25	9.37		29.84	23.31
5A	160.62	165.00		4.38	32.81	32.50
6B	187.00	188.50		1.50	24.62	22.25
6A	205.00	204.50	.50		27.50	21.14
Total	165.83	159.25	6.58		37.03	34.08

2. Per cent. of each grade reaching the 75 per centile of all.

Grade	4A	5B	5A	6B	6A
Boys	9.67	18.97	19.95	42.85	62.00
Girls	2.27	10.45	24.13	45.65	64.37

3. Per cent. of boys reaching the 50 per centile of the girls.

Grade	4A	5B	5A	6B	6A
Per cent	45.1	58.2	44.6	50.0	50.0

4. Per cent. of gain from grade to grade.

Grades	*boys*	*girls*
4A to 5B	32.44	12.50
5B to 5A	3.21	12.82
5A to 6B	16.43	14.24
6B to 6A	9.62	8.48

For both boys and girls there is marked progress from grade to grade, the total percentage of gain in ability being 74.4 for boys and 57.3 for girls. Variability for both sexes is slightly lower in the upper grades.

Age differences.—There is, on the whole, a loss in ability with the progress of age for boys, and a gain for girls. The former reach their maximum at twelve years, the latter at thirteen. The youngest 25 per cent. are superior to the oldest 25 per cent. in every grade, with the exception of the boys of grade 6. Both older and younger pupils fall below the median for the grade in certain of the tests. The variability of the younger boys and of the older girls is slightly greater.

Sex differences.—In all, the boys reach a higher median than the girls. If a grouping were made of the best 25 per cent. of all the pupils it would contain a larger per cent. of boys from grades 4A and 5B, and of girls from the other three grades. The boys are generally superior up to twelve, and the girls afterwards. The boys, on the whole, are more variable in every grade. When the tests are considered separately, however, the girls in some are more variable. Where one sex has a higher median, the other shows greater variability. There is, for boys, a marked difference in ability between the A of one grade and the B of the next, but little between the B and the A of the same grade. This Bonser explains on the ground that more care is taken in promoting from one grade to the next, than in permitting continuance in the same grade. The girls apparently show a greater tendency toward regularity in their work.

Sex differences among the tests.—The boys are decidedly superior in the tests of mathematical judgment; they excel also in the tests of selective judgment among reasons for the truth of a statement, and are slightly ahead in the tests in controlled association in which the significant word is supplied by the pupil. The girls excel in the opposites test, and in the test for selective judgment among definitions; they are especially superior in the interpretation of literature. These latter tests, Bonser points out, deal with words in a special way.

The superiority of the girls in them may be due, he thinks, to attention to detail, to more patience in analysis, to keener sense of the meaning of words and phrases, to a more accurate form of expressing meaning,—or to a combination of some or all of these factors. Moreover, boys of this age do not as a rule like poetry; their attitude would be to rid themselves of the matter as soon as possible. On the whole, the resemblances between the sexes are far greater than the differences.

Relative difficulty of the tests.—The most difficult of the tests, as shown by the ratio of the median grades to the highest possible grade, is that for literary interpretation; then comes selective judgment; then mathematical judgment; and finally, easiest of all, comes controlled association.

Correlations of individual abilities.—The coefficients of correlation for the individual abilities in each of the tests with those in each of the others were worked out. Of these the highest are (in order from highest to lowest) .53 for the tests in which sentences are to be completed by the pupil and the opposites test (controlled associations); .49 for the opposites test and the test in selective judgment among reasons for the truth of a statement; .47 for the latter and the test in selective judgment among definitions; and .45 for the test in supplying a significant word in a sentence (controlled association) and that in literary interpretation. The coefficients of correlation for the ability in each test with that in all the tests taken together are (in descending order) .85 for the opposites test (controlled association); .73 for the test in selective judgment among reasons for the truth of a statement; .59 for the tests in mathematical judgment; .58 for the test in selective judgment among definitions; .55 for the tests in supplying significant words in sentences; .37 for the test in literary interpretation. The opposites test thus seems to be one of superior merit as a single test of the several abilities here measured. Correlations on the basis of age are much higher than those on the basis of grade, indicating greater homogeneity within the age groups; there is also a tendency toward higher correlation among the boys than among the girls.

From the progressive development in median ability, and from the high correlations found to exist among the several varieties of ability tested, Bonser concludes that the tests measure one general species of ability, complex though it is. The fact that native capacity rather than the result of training is measured, the author believes to be indicated by the contrasts between grade progress and progress with age, by the

superiority of younger over older children of each grade, by the fairly substantial percentage of pupils of the lower grades in the highest quartile of ability for all, and by the evident sex differences. "The point of greatest pragmatic significance for the school lies in the implications from the two facts that there are substantial percentages from both lower and higher grade groups in the highest quartile (25 per cent.) of ability for all, and that the youngest pupils of each grade show higher ability than the oldest, and sometimes than the grade as a whole. It is that perhaps the worst type of retardation in the schools is the withholding appropriate promotion from those pupils who are the most gifted and therefore of the most significance as social capital."

Bonser points out the fact that mental abilities are too complex to be rated extensively in the mass, as smaller groups within the larger often show opposite tendencies. In an exceedingly thoroughgoing fashion, he gives detailed results for each test, grouping the pupils by age, sex and grade; consideration of these results must be omitted here. The limitation of the tests to deductive reasoning seems unfortunate, as it puts a premium upon memory of certain methods of procedure already learned by the pupil, perhaps in the most routine way; this is particularly true of the tests of mathematical judgment. The questions and statements of the tests of controlled association and selective judgment are not well calculated to arouse any immediate interest in the child; fulfilment of the requirements depends upon information he may chance to possess, rather than upon any observation of his own. The tests have been devised from the point of view of an adult; they present no situations which are vital to the child, and which would be liable to stimulate such powers of thought as he may possess. Again, as regards method, it is a well-known fact that class-room experiments are frequently vitiated by such distractions as are incidental to the intrusion of a stranger into the school-room, *i. e.*, uneasiness and self-consciousness on the part of the pupils; there is no indication that precautions were taken to avoid this very real difficulty. Moreover, the collection of the papers upon the completion of the first one might easily place the best reasoners at a considerable disadvantage, for the reason that the best reasoner is not necessarily the most rapid one. Such a system of timing increases the liability of the use of ready memory of mere routine methods of work, or of careless or slipshod answers.

The preceding studies represent efforts to analyze rather superficially the reasoning processes of a large number of

individuals. A different type of experiment is that seen in Terman's study (35), which aimed at a minute qualitative analysis of the logical processes of a few individuals. This author used as subjects seven of the brightest, and a like number of the most stupid, boys of the schools of Worcester, as selected at his request by the teachers. The ages of the subjects ranged from 10 to 15. The experimentation was carried on in the psychological laboratory of Clark University. Terman tested the boys on puzzles, designed to bring out such logical processes as took place, on mathematical ability, mastery of language, interpretation of fables, learning of chess, memory, and motor ability, as shown by the practice curve in learning such coördinations as those involved in catching a ball in a cup, carrying a book on the head. Only a few of the general results can be given here. The bright group is superior in the mental, and inferior in the motor, tests. The standing of individuals through the tests is strikingly uniform. The duller group discloses no inferiority in persistency and concentration; on the contrary, four of the brighter ones are much more fitful and spurty in their efforts. The methods of work indicate on the part of the brighter subjects associations that are more volatile, spontaneous, and based on more subtle resemblances, and on the part of the duller ones associations that are close, matter-of-fact, and labored. When the boys were asked whether they preferred to read or to play games, all but one of the brighter group preferred reading, while all of the duller preferred games. Endowment, Terman thinks, has a greater importance than training in determining the intellectual rank of an individual.

2. *Arithmetical Ability of Children. Its Nature and Relation to the Course of Study and Method of Teaching.*—Mercante (22), in his investigation of the psychology and cultivation of mathematical efficiency, assumes a neurological viewpoint throughout. He stresses the integrative activity of the nervous system; any mathematical process is an integration, beginning with an auditory or visual perception, and ending with a motor act, after a more or less complex subjective manipulation. Upon the readiness of the associative processes depends the exactitude and speed of the work. Mercante lays down the fundamental postulate that the degree of mathematical efficiency is inversely proportional to the time required for the working of problems in the four fundamental operations of arithmetic, addition, subtraction, multiplication, and division, and for the reading of numbers. Twenty different experiments were made; among the abilities tested were counting lines, reading and copying numbers, writing num-

bers from dictation, reproducing numbers visually (setting them down on paper immediately after their exposure), calculating mentally (simple examples in the fundamentals), and solving problems. The children tested were 134 girls and 93 boys of a school in Argentina, their ages ranging from seven to fifteen. From the vast body of data thus obtained the author constructs numerous tables and curves. Among the important findings are the following: There is rapid progress from the first to the fifth or sixth grades; afterward improvement is slower. In counting lines, the relation between accuracy and time shows a constant positive correlation; boys are more accurate, showing more rapid accommodation and convergence of the eyes; the 'integration' of the girls wavers more. There is greater difficulty and less certainty in reading numbers containing zeros (101,010) than those free from zeros; the girls are more accurate in the latter, and the boys in the former. In writing numbers from dictation, the first place at the left is filled with more accuracy, the place at the right coming next; this Mercante explains on the ground that the first and last figures heard tend to persist most strongly. The writing of numbers is ordinarily unconscious; too close attention to the process results in error. Boys 'integrate' in auditory-motor fashion, girls in auditory-visual-motor; the former are more rapid and accurate. From the experiments in the visual reproduction of numbers Mercante concludes that the visual-writing association is the most rapid one which the brain is able to make. The central digits are more accurately reproduced than initial or terminal digits; boys err more often in permutations of digits, and girls in substitutions. Girls show a higher degree of attention in this test. In mental arithmetic, accuracy and speed show a positive correlation. Multiplication is hardest, then subtraction, and addition. Efficiency improves greatly with practice; there is necessity for much drill in the lower grades, if accuracy is to be secured in the higher ones. In problems (complicated integrations), the boys excel after the ninth year. Attempts are made to analyze the mental concomitants (imagery) of the solutions. Conclusions regarding the imagery employed by the pupils are often rather more decisive than the data warrant; there is throughout an unfortunate tendency to adopt the exceedingly treacherous procedure of theorizing as to the processes which *must* be employed by the pupil in performing a certain task, and interpreting the results accordingly. Little evidence appears that the author is familiar with the work of other investigators in the field.

Ranschburg (28) aimed to test the efficiency of 153 pupils

of the first to the fourth classes in performing simple examples in addition, subtraction, multiplication, and division. He introduced a variation which consisted in notifying of pupils when their answers were incorrect, and allowing ten seconds for correction; the number of corrections necessary served as a measure of objective certainty. The results from 9945 individual records showed a progressive improvement from the lowest to the highest classes. Speed increased with age and practice. The order of difficulty for the fundamentals, beginning with the easiest, was found to be the following: addition, multiplication, subtraction, division. Multiplication was most rapidly performed; next in point of speed came addition, then division, and finally subtraction. The differences in speed Ranschburg accounts for on the basis of the greater mechanization by drill of certain of the fundamentals. Speed he regards as the most significant and satisfactory criterion of mental stage and ability; as a simple mathematical formula for the measurement of efficiency and its expression in a single figure he proposes the following: amount of work done (*Leistung*) equals accuracy divided by time. Ranschburg, in a later study, compares the arithmetical ability of normal and of feeble-minded children. He comes to the conclusion that the time necessary for subtraction furnishes the most important clue to the mental condition.

Rice (29) deplores the fact that "the ship of pedagogy has become waterlogged in a sea of opinions;" he would fain have "efforts made to point the ship in a different direction to find whether we can get out of the trough." Let us take the attitude of scientific inquiry! The method he proposes for establishing facts regarding the much agitated question of the products of different school systems is that of subjecting the children trained under them to one and the same test,—which must be fair and practical,—and comparing the results. He himself gives the data gathered from such a test in arithmetic. His specific problems were to determine in so far as possible what results should be accomplished by the school program; how much time should be devoted to the study, and why some schools secure satisfactory results with a reasonable time allowance, while others fail, despite an inordinate proportion of time. The tests were five in number, one for each grade tested (fourth to eighth, inclusive). Each test contained eight arithmetical problems, selected to suit the grade to be investigated. Some of the problems were carried through several grades; thus, five of the fourth grade problems were repeated in the fifth grade, three in the sixth, etc. Basis for observing the growth from year to year, and for comparison

of different grades in the same and different schools, was thus afforded.

The subjects were 6000 pupils of 18 schools, representing 7 cities. The author was present during the giving of the tests, in all cases. In scoring the papers, only those examples were considered which had been correctly worked in principle; of these, the percentage containing mechanical errors was recorded.

Rice found enormous variations among grades and localities. The grades showing the greatest differences in different localities were the seventh and eighth, class averages ranging from 8.9 to 81.1 per cent. in the former, and from 11.3 to 91.7 per cent. in the latter. The averages for schools as wholes ranged from 25 to 80 per cent. Some showed fair uniformity throughout the grades; in others, marked variations in certain grades were offset by variations in the opposite direction in other grades. In nearly all cases, different schools of the same city showed similar degrees of ability.

Mechanical errors were few. The curve falls from the fourth to the sixth grades, and rises in the seventh and eighth. These fluctuations Rice accounts for on the grounds of effect of drill, and different bases of comparison,—the non-identity of the tests. The schools showing the best thinking (greatest proportion of correctness in the method of solution) made fewest mechanical errors.

No direct relation was discovered between the amount of time devoted to arithmetic and the degree of ability attained. The facts indicate that 45 minutes per day will suffice, though there is no reason to conclude that that amount of time is actually required to obtain satisfactory results.

How shall we explain the variations among schools and grades? Evidently, says Rice, they are due either to the influence of the teaching, to resistances to that influence over which the teacher has no control, or to misdirected effort on the pedagogical side. As regards the first possibility, it appears that the teachers in the poorer schools were as conscientious and as well-trained as those of the better ones. Resistance to the influence of the teacher may consist of three elements,—the home environment of the pupils, the size of the classes, or the ages of the children. Now in the investigation under consideration, there was no relation between the neighborhood (aristocratic or the reverse) of the school and the standard of work attained; the classes were actually larger in the six best schools, and smaller in the poorer ones; and the ages of the pupils of the higher and lower schools were approximately the same, as shown by the grade averages. It

would seem, then, that the principal cause of failure consists in misdirected effort on the pedagogical side.

The pedagogical side of the problem is considered by the author in two divisions, the factors brought into play by the teacher, and by those appointed to direct and supervise the work of the teacher. Under the first division Rice discusses methods of instruction and teaching ability, as represented by a combination of education, training, and personality of the teacher. Methods of teaching, he says, cannot be looked upon as the controlling element, as in the better schools no methods other than the ones commonly used were employed; nor did thoroughness in reviewing invariably make for success, as the review might be merely formal and lacking in qualities that stimulate thought. As to the matter of the qualification of teachers, we should expect variations here to be indicated by marked differences among different class-rooms of the same locality, a condition which does not appear in the results. So the source of the difficulty is left at the door of the supervisor. Now the leading functions of the superintendent are the preparation of the course of study, the suggesting to teachers of improvements, and the establishment of standards and testing for results. The causes for variations could hardly be found in the first two of these, as the tests questions were general in nature and confessedly fair to all, and superintendents' meetings and visits had been in vogue in all the localities tested. Therefore, the controlling elements are contained in the last,—the establishment of standards and testing for results. There are four prevalent modes of standardization. They are: (1) Tests made by the teachers themselves; (2) Tests made by the teachers, supplemented from time to time by others devised by the superintendent; (3) Tests made by the principal, for his own school; (4) Tests made by the principal, supplemented by others of the superintendent. The poorest schools were those in which testing had been done by the teacher alone. This is due, Rice thinks, to a tendency on the part of teachers toward routine work, resulting in the failure of their pupils in problems unusually formulated. Where the tests of teacher or principal are supplemented by those of the superintendent, results are much better; certainty that pupils will be examined on problems formulated in different ways leads the teacher to inculcate knowledge of the underlying principles. Much depends on the superintendent's questions; they must be suggestive and stimulating of independent thought, and based on the normal mental capacity of the children. Knowledge of what the average child who has been well taught is capable of doing is to be gained only by extended study.

There appear, in Rice's investigation, certain obvious defects in method and in treatment of results. The factors influencing the development of arithmetical ability are far too numerous and complex to admit of the separate treatment, and simple logical analysis accorded. The work proved very suggestive in the new lines of educational research indicated, however. Stone (34) was the next to open extended investigations in the field. This author points out the following defects in Rice's study. As to method, he says, Rice makes no statement indicating whether or not he used a time limit; neither have we any means of knowing how the tests were placed before the pupils. Rice's tests, moreover, were inadequate in that they attempted to measure both reasoning capacity and ability in fundamentals by means of the same problems. These are different abilities, and should be separately measured. The tests, likewise, call occasionally for the employment of operations with which the pupils have not yet become familiar. The method of scoring is unsatisfactory; there is no evidence that the relative difficulty of the problems was determined experimentally; and identical scoring units were assigned to problems of different degrees of difficulty.

As to the treatment of data, Stone points out that it is desirable to print more than mere averages; far too few of the data are presented in Rice's results. In his own study he proposes to introduce the following improvements: to take account of the kind and arrangement of the subject-matter in the different courses of study, and also of the place given to drill; and to gather and handle data in a more refined way. He states his problem as follows: "What is the nature of the product of the first six years in arithmetic work? And what is the relation between distinctive procedures in arithmetic work and the resulting abilities?" Again, the test method is used. The tests were two in number, one in fundamentals, containing fourteen examples in addition, multiplication, and division, and having a time limit of twelve minutes; the other in reasoning, containing twelve problems, similar to those found in any text-book of arithmetic, and having a time limit of fifteen minutes. These tests, Stone believes, represent phases of arithmetic work in which no system can afford to fail in producing ability. All tests were personally conducted by the author, directions being given orally by him, except as printed on the test slips. No announcement of the tests was made in advance to the pupils; and teachers were asked to have as little as possible to do with the pupils during the work. The subjects for the investigation were pupils of the 6A grade in each of 26 school systems of New England,

the middle East, and the middle West; 6000 papers were obtained.

The main results were as follows:

Arithmetical abilities; variability and relationship.—There is decided lack of uniformity among systems, both in amount of work done and in accuracy. The variation among individuals within a system is even greater. There are no appreciable sex differences in variation. Extensive tables of coefficients of correlation are given, to show in how far the possession of one ability implies the possession of others. Among different systems, the fundamentals are closely correlated with each other (.92 to .95), the lowest coefficient being that between addition and division; subtraction is most highly correlated with reasoning (.50), and addition least so (.32). The coefficient of correlation of reasoning with all fundamentals is .40 for all the systems, and .73 for all systems except those in which there is a special emphasis upon the fundamentals, a finding which Stone interprets to mean that these coefficients measure the influence of teaching rather than individual capacity of the pupil. Among individuals, the relationship obtaining between different abilities is decidedly less close than among systems. On the whole, then, reasoning ability implies ability in fundamentals no more than mathematical ability implies ability in English. Like Rice, Stone found that systems in which there was supervision by superintendent or supervisor did slightly better than those without such supervision, and that the best work was done under the supervision of both superintendent and principal; he takes pains to state, however, that his results do not show this at all conclusively. He does not attribute so great a potency to the tests as does Rice, for the reason that in those systems in which the supervision was in the form of tests the pupils did better in fundamentals, but their work in reasoning was distinctly inferior.

Arithmetical abilities in relation to time expenditure.—A blank containing careful inquiries as to the amount of time and energy devoted to the different studies of the school curriculum by teachers and pupils was submitted to each principal. From the data thus secured Stone finds no direct ratio between time expenditure and ability. In all schools where home study is the practice, the ability in relation to time spent is somewhat greater. The relation between time spent and ability in fundamentals is closer than that between time spent and ability in reasoning.

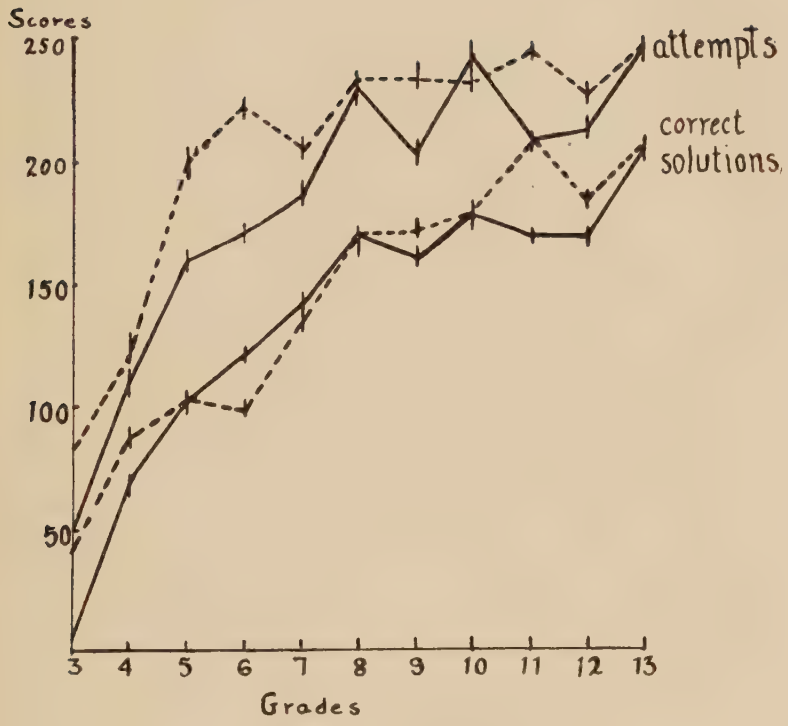
Arithmetical abilities in relation to the courses of study.—Careful statements of the courses of study followed were

secured from the various teachers. Then ratings of the different courses of study as to degree of excellence were made by twenty-one professors and graduate students in education, each of whom had had practical experience with and made studies of elementary school curricula. It was found that the systems constituting the inferior half as regards course of study showed a higher degree of ability than those of the superior half. The courses of study were next rated by nine competent judges according to emphasis on concreteness ("extent to which the problems offered are such that their solution will put the pupils in possession of the quantitative aspects of the lives they are experiencing") or emphasis on drill. Here again results were negative, the relation between emphasis on drill and ability being somewhat closer.

Stone concludes from his study that the greatest need of our school systems is standards of achievement. There is apparently no one factor that produces ability,—no single *summum bonum* in arithmetic teaching.

The problem of Rice and Stone is next taken up by Courtis (7), who aimed to ascertain the facts regarding the development of arithmetical ability throughout the grades of a private school for girls in Detroit of which he is principal, and to measure the change produced by a year's regular work under the existing conditions. These two divisions of the investigation will be considered separately.

The development of arithmetical ability was studied by means of tests, two in number, one on fundamentals, containing fourteen examples in addition, subtraction, multiplication, and division, and one on reasoning, consisting of twelve arithmetical problems. The subjects were 317 girls, pupils of eleven grades (third to thirteenth), the average number per grade being 23. The method of instruction was individualistic; the classes were sectioned as soon as they reached 12 in number and frequent interviews were held between teachers and pupils. At the time of the investigation the departments of science and mathematics had for two years been combined, and an objective laboratory system had been in effect. The procedure of the experiment was as follows: The tests were distributed among the girls in the assembly room of the school on successive days, the time being in all cases the middle of the morning session. The pupils were not informed in advance that tests were to be given; the instructions were for each to do her best for the honor of the class. The time limit was twelve minutes for the test on fundamentals, and fifteen for that on reasoning. A record was kept of attempts, as well as of correct solutions; this difference furnished an index of accuracy.



RESULTS OF COURTIS

Curve showing achievements in fundamentals and reasoning. Full lines show fundamentals; dotted lines show reasoning.

From the results it appears that the product of the present educational system is very uncertain. The distribution of ability in all grades after the fifth is very irregular. The curves for fundamentals and reasoning do not follow each other very closely, nor is their relation uniform throughout the grades. Skill in one branch is not necessarily accompanied by skill in other branches; from this it may be inferred that special training has but little value for the development of general ability. Among fundamentals, addition is hardest and multiplication easiest. This is due, Courtis thinks, to the fact that more emphasis is placed on the multiplication and division tables than on the addition; it shows that methods of training are haphazard, not based on insight into the real difficulty. There is great need of all-round early training. The test in fundamentals is more difficult than that in reasoning, as the latter rises to a maximum earlier. The fact that the sixth grade was inferior to the fifth shows the need of special and vigorous training for the former,—although, indeed, the very factors that lead to its inferiority may later bring about increased ability. The inaccuracy of grades five and six was due to the fact that these grades, working with fractions, attempted problems involving fractions, but could not solve problems involving partition, as some of those attempted did.

In the second part of the study,—the investigation of the change produced by a year's regular work,—the tests were somewhat altered. Besides the two previously used, others, especially calculated to test speed in fundamentals and reasoning, and in correct copying of figures, were employed. The reason for the introduction of these extra tests lies in the fact revealed by the previous experiment, that arithmetical ability is really a complex of a large number of separate abilities, among which there is little evidence of transfer. The speed test in fundamentals was composed of very simple examples in the four fundamentals; the time limit was 90 seconds. The speed test in reasoning consisted in a collection of simple one-step problems, after each of which was left a blank space, in which the pupil was asked to write the name of the operation called for; the time allowance was 2 minutes. Particular attention was directed to the operations of borrowing and carrying in the original test on fundamentals, as these in themselves represent particular abilities. This measurement was effected by means of the comparison of examples which did not require borrowing and carrying with others in which these operations were necessary. The tests measuring the rate of motor activity in copying figures consisted in 21 five-

place numbers, to be copied by the pupils. The time limit was one minute. The procedure consisted in giving all five of the tests during the second week of school, and again in the final month; the speed and copying tests were given at intervals during the year,—at the end of six weeks, before and after the Christmas and Easter vacations, and weekly during the last ten weeks.

The results of the previous test were confirmed. In addition to them, it was found that mistakes in copying constituted from 8 to 40 per cent. of the total number of errors made. The introduction of carrying doubles the difficulty of examples; that of borrowing, curiously enough, does not increase it. For grades studying arithmetic, the ability to borrow and carry was greater in June; for those not studying arithmetic, the reverse was the case. There is a close correlation between speed in copying figures and speed in single examples up to a certain point (115 figures per minute); beyond this, there is no indication that increased speed in copying figures is accompanied by more rapid performance of examples. It appears, also, that there is a critical degree of knowledge of the tables, beyond which an increase in score does not carry with it an increase in ability to work examples.

By far the most striking fact brought out in Courtis' work is that of the immense variability of individuals within a grade. This is clearly illustrated by superimposing on one chart the zones between the upper and lower mean variations of the fifth, sixth, seventh, and eighth grades. The remarkable fact appears that for two-thirds of the year a considerable part of the area covered is common to all four of the grades, and for the whole time a large part is common to three grades. In other words, the eighth grade contains a great number of pupils of fifth, sixth, or seventh grade ability only. There is, apparently, no such thing as a grade standard. This, Courtis believes, is largely due to the failure of many pupils to secure all-round development in fundamentals in the lower grades. The present system does not minister adequately to the needs of different individuals. For overcoming these difficulties, without sacrificing the advantages of group work, Courtis recommends the establishment of standard scores, stages of progress, for each grade, to be measured by standard tests; that would make possible individual prescriptions. That such tests are reliable measures of ability is proven, he thinks, by the consistency of grades and individuals in his own results. He is at present engaged in an effort to establish clearly defined grade standards, on the basis of the abilities of a large number of children of different localities.

3. *The Relations Between the Different Arithmetical Operations.*—Lobsien (21) undertook to determine the relation between memory for numbers and ability in arithmetical work. He gave memory and arithmetic tests to 50 pupils, of ages from nine to ten years, in six classes of a boys' *Mittelschule,* fourth year. In the memory tests, two-place numbers were exposed for definite periods of time, the percentage remembered furnishing a measure of memory. For testing visual memory, the numbers were exposed visually, simultaneously; for testing auditory memory, they were read to the pupils. The arithmetic tests were both written and oral; they consisted of examples in the four fundamental operations. The following are the coefficients of correlation obtained: Auditory memory with oral and written arithmetic, .24 and .18 respectively; visual memory and oral and written arithmetic, — .32 and —.06 respectively; oral and written arithmetic, .23; auditory and visual memory, .17. Visual memory for figures has little to do with either oral or written arithmetic; the efficient worker in arithmetic has a good auditory memory. These results appear somewhat unreliable for the reason that visual or auditory presentation furnishes no guarantee that the pupil will employ a visual or auditory method in his retention. Huther's paper (15) is non-experimental; his main contention is contrary to Lobsien's findings. Erler (12) takes up the same problem, using as subjects pupils of the third year classes of a *Bürgerschule.* His memory tests were three in number, each consisting in the recall of as many as possible of eight two-place numbers, read at five-second intervals. In the first test, the instructions were to refrain absolutely from moving vocal organs or hands (mouth to be kept tightly closed, and hands doubled up); in the second, there was no restriction of movement, but no audible speech was permitted; in the third, the figures were repeated aloud by the pupils. The arithmetic tests consisted in examples in the four fundamentals. Erler obtained slightly higher correlations between both kinds of arithmetic and "pure auditory memory" (first memory test) than did Lobsien; the correlations between the results of the second memory test and arithmetical ability were higher, and those between the third memory test and arithmetical ability still higher. The weaknesses of Lobsien's work,—assumption that auditory memory is necessitated by the presentation of the auditory stimuli,—appear again in this investigation.

Brown (5) emphasizes the need of a more satisfactory account of the psychology of reasoning than that furnished by the introspective method. His problem was to collect data

on the various mathematical abilities of children. He gave tests in arithmetic, geometry, and algebra to 83 boys of an English public school, their ages ranging from thirteen to seventeen. The results show a close relation between memory for propositions in geometry and power of recognizing general relations; the most important ability in geometry is that of remembering preceding propositions. The coefficients of correlation between the three branches of mathematics tested were as follows: geometry and algebra, — .05; geometry and arithmetic, .23; algebra and arithmetic, 75. The negative correlation between geometry and algebra indicates that geometrical ability is related to algebraic only through the mediation of arithmetic; this is in harmony with the view that mathematical reasoners fall into two types, geometrical, or intuitional, and analytical, or logical. The close relation between algebra and aritmetic is due mainly to habits of accuracy common to both. The ability to do percentage and proportion in arithmetic was found to be more closely related to geometrical than to algebraic ability. The precise aim of this study is not clear to the writer; Brown apparently intends to throw some light on reasoning ability of children, though just what he means by reasoning is not very evident. He seems at times to be combating something akin to the faculty doctrine of reasoning. To his tests the objection may be made from this viewpoint that they measure little besides memory for foregoing methods of work. A number of his conclusions seem hardly warranted by his data, notably that of the mediation of arithmetic between geometrical and algebraic ability.

Fox and Thorndike (13), investigating the relationships between the different abilities involved in the study of arithmetic, gave tests in addition, multiplication, fractions, rational computation, and simple arithmetical problems to 77 high school students of ages ranging from fourteen to twenty, 28 boys and 49 girls. All tests were given by the same individual; each was timed, the time being uniform and short enough to prevent any from finishing. The individual records of ability thus obtained were correlated; the coefficients are as follows: addition with multiplication, and fractions, .75 and .19 respectively; addition and multiplication with fractions, with problems, and with both fractions and problems, .46, .55, and .54 respectively; fractions with problems, and rational computation, .44 and .58 respectively. Thus, different relationships and mutual independence exist between the different forms of ability tested. Skill in the solution of problems is no more closely allied to skill in working with

fractions than to efficiency in the mere associative processes involved in adding and multiplying, a finding which the authors attribute to the alleged fact that the vast majority of pupils use neither arithmetical analysis nor reasoning. The girls do about 5 per cent. better, on the whole, than the boys; their variation is 92 per cent. as great. The data show no reason for sex differentiation in arithmetical training. The authors point out, however, that in the town where the experiment was conducted many of the brightest boys go to work immediately upon graduation from the grammar school, and that consequently the high school has an unfairly large proportion of mediocre boys and of bright girls.

Starch's (33) purpose was to obtain data on the transfer of training in arithmetical operations. His subjects, 15 in number, he divided into two groups of 7 and 8 each; his method consisted in giving to all the subjects two sets of tests, one before and one after an interim of two weeks, during which the group of 8 was drilled in mental multiplication of three-place numbers by one-place multipliers. The tests were eight in number, six dealing with the four fundamentals and two with memory span for numbers and words. Comparison of the efficiency of the drilled and non-drilled groups after the final tests revealed an improvement of from 20 to 40 per cent. for the former, and of 20 per cent. for the latter. The memory span was not affected. Introspective data showed that the improvement was due to the acquisition of an increased ability to keep numbers in mind, and to the application to other operations of elements acquired during the training. Visualization, supplemented and prevented from confusion by inner speech, was common. Winch's (37) problem was this: Is there such a thing as a habit of accuracy? Will accuracy be transferred from one subject-matter to another? If so, is the relation a causal one, or is it due to a factor which is common to both? The specific object was to test the transfer from practice in numerical accuracy to arithmetical reasoning. The method consisted in giving to all his subjects,—pupils of four schools, ages for the most part averaging ten years,—three tests each, alternately, in arithmetical problems and 'rule sums;' then, on the basis of the ability shown, in dividing them into two approximately equal groups, one of which was practiced for a time (4, 6, and 10 days in different schools) in 'rule sums;' and finally, in giving to all another test in problems. The first tests showed rather high positive correlations between ability in reasoning and accuracy in numerical computation (coefficients, .69 to .85). The drill sections showed decided improvement in accuracy during

the course of the drill. As regards the existence of transfer, however, the results are negative, or practically so. In the two schools which show a slightly greater improvement in the final test on the part of the drilled than of the non-drilled,—for both sections show improvement,—there are large subgroups in both sections which show superiority in the non-drilled pupils. There is some superiority for the drilled sections in the mechanical work involved in solving the problems; this may account for the slightly higher scores, where they occur. In a second test, the following changes in method were made: The first tests were given just before the summer vacation; the drill took place during the first two weeks of the following fall semester; and the instructions were for the pupils to indicate how they would solve the problems. Again, there was absolutely no evidence of transfer.

J. C. Brown (4), the subject of whose investigation was the value of drill work, examined 51 pupils, their average age being thirteen years six months; a test in fundamental operations and arithmetical reasoning (problems) was given; the pupils were divided into two equal groups on the basis of the marks, and one of these groups was drilled, orally and by written work, during a specified part of the next thirty recitations. A final test in reasoning and fundamentals showed improvement in both, especially the latter, the improvement being most marked in the drilled section. The benefit of the drill was greatest in the sixth, and least in the eighth, grade; it persisted during the summer vacation, as was shown by tests in the fall.

A general survey of the field covered in this paper reveals some fairly well-established facts, many possibilities, and a large number of problems yet to be solved. As regards the arithmetical ability of children, perhaps the most striking fact is that of the immense variability among different individuals who have been subjected to the same school training. The reason for this disparity remains to be determined. Certainly none of the investigators mentioned have succeeded in ascribing it to any definite cause, or set of causes. Stone's results are confessedly largely negative; Rice reached his conclusion,—that inequalities must be ascribed to poor supervision,—through a process of logic rather than from his experimental data. Courtis and others have as yet done little more than to state the problem in a slightly different form,—that the relative amount of training given to different branches of arithmetic is based on conjecture, rather than on experimental determination of where training is needed. Courtis proposes, as a means for overcoming this lack of uniformity, the use of

careful diagnostic tests, with individual or small group remedial measures.

It appears also that the abilities implied in the arithmetic work of the school are many and varied; that they are largely independent of one another; that there is little evidence of transfer in any such sense as that a brief drill in one operation is attended by an improvement in other operations. This whole general problem and its numerous attempted solutions raises a series of interesting questions. Is the non-existence of transfer due to the method of drill which has been employed? Would not a training which consists in a conscious and deliberate attempt to create in the child's mind the attitude of analysis and synthesis in conformity with certain well-understood principles, in the presence of any problematic situation which might be presented to him, with the habits of concentration involved,—would not such a training lead to an improvement in any field of endeavor where such an attitude is useful or advantageous? Investigators of transfer have drilled their subjects in an exceedingly blind fashion; and it seems safe to say that the acquisition of skill and efficiency during the period of practice has consisted essentially in the unreflective mechanization of a circumscribed group of motor acts or in the acquisition and facilitation of a circumscribed group of associations. There has been little or no attempt to promote the acquisition of principles which possess any degree of generality; and there has been no attempt to inculcate an understanding of the purpose of it all.

The reasoning capacity, if it be conceded that such tests as have been employed really measure it, makes its appearance rather late in the grades. Children frequently fail through employment of imperfect or false concepts, lack of ability to express themselves, or tendency to apply principles in a hit or miss fashion, showing that they have failed to comprehend general laws, or have learned to apply them only in a routine way. Children learn to perform specifically formulated problems according to a given method, and any change in the formulation of the problems leaves them wholly at sea.

But there is, perhaps, one main objection to all the tests which have been used. Before considering it, it would be well to determine, tentatively at least, what is the nature of the series of purposive associations called reasoning. Reasoning has been defined as an attempt to meet adequately any situation, by recognizing certain elements in that situation which are identical with known situations, and reacting to them accordingly. Acuteness of reasoning depends on ability to analyze situations carefully, and to detect minute resem-

blances. The formation and testing of hypotheses consists ultimately in grouping together a number of resemblances which experience has shown to be valid, and in determining whether they also hold in further experience, *i. e.*, the present instance. Reasoning is implicit if, in proceeding from the known to the unknown by way of detected resemblances, no effort is made to discover in just what that resemblance consists; it is explicit if the relation of identity is analyzed. If such a definition of reasoning be accepted, few, if any, of the tests which have been employed really measure its presence in children. The situations which have been presented do not constitute problems which appeal to the child; they are selected from the point of view of the adult. Success in meeting them depends largely on the child's memory of certain methods of past procedure, not on his capacity to reason either in an implicit or explicit fashion. The 'native capacity' which Bonser claims to test is, from this point of view, little else than ability that a given method of procedure already learned is now to be applied. Some of the tests, to be sure, involve analysis, but it is analysis of an artificial sort.

If this criticism is valid, the investigations so far must leave most of the questions regarding the reasoning of children. The vast differences in the range of experience, environment, and interests of different children make it an extremely difficult task to devise tests which would determine the extent to which the child mind possesses the attitude of the reasoner.

In conclusion, it seems wise to call attention to an antithesis which has been pointed out between two different modes of mental activity. Meumann speaks of an objective and a subjective type of thinker. Poincaré distinguishes two types of mathematicians, an intuitional, or geometrical, and an analytic, or algebraic. Lessing (19) undoubtedly has much the same distinction in mind when he speaks of an extrospective and an introspective type of scientist. The former type includes the natural scientists, those whose main interest lies in the observation of objective facts; to the latter type belong the metaphysicians and the pure mathematicians, whose chief interest is to analyze and to systematize the logical processes by means of which their conclusions are reached. This antithesis is to be found in children, as well as in adults, according to Lessing. Certain children take pleasure in numerical combinations and in mathematical speculations, while others prefer the observation of nature, the collecting of plants and animals, and the like. Race plays a part in this differentiation; Jewish children, for instance, are extremely concrete and practical in thought as well as in action. Lessing's sug-

gestion offers an interesting subject for further investigation; such differences as he indicates, if they exist in children, must be taken into account in any attempt to devise tests which will serve for the establishment of reasoning norms. The problem, as it stands, is one of the most important ones for future investigation.

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SOCIAL PEDAGOGY

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I

This is an age of doubt, doubt in almost every department of life. Party politics, religious creeds, social societies, and schools of thought no longer exert so strong a grip as in the "good old times." This is one of the most hopeful symptoms pointing to a favorable prognosis. To doubt means to think. To think is to investigate. To investigate is to look for truth, and—"the Truth shall make you free."

"Jeder tüchtiger Denker ist zuerst Zweifler." Every great reformer was at first a doubter and then an innovator. Luther, Calvin, Knox, Wesley, Tolstoy—all began as sceptics. So it has been, and ever will be, with the reformers of any kind. Emerson said: "The reputation of the nineteenth century will one day be quoted to prove our barbarism." This is true. We educators and teachers of to-day point to the fact that our theoretical and practical professional fathers tyrannized over their pupils with nonsense memorizing, premature reasoning and one-sided development. This we consider barbarous. Some day we will be pointed at to prove the gross error and ignorance of our present educational and school methods, which are characterized by quasi-pedagogical prescriptions.

Have we reached the limit of pedagogical progress? If not, are we to be content as mere followers? Shall we, practical and theoretical teachers, continue our classical habit of letting some psychologist, sociologist, theologician, physiologist, anthropologist, historian, economist, hygienist, or philosopher, do our thinking, and then joyfully accept what he proclaims? We accept the truth gladly, no matter by whom discovered, but we do not wish to be mentally trammelled by the *ipse dixit* of any little educational "leader," common school council, school committee, educational stickler, or hidebound board of education. The rank and file of our great profession (unfortunately not organized as a profession) are beginning to doubt these so-called educational authorities. They have begun to doubt.

Most of us are liable to look at the school from an *individualistic* point of view only, as a matter between teacher

and pupil. But there is an increasing army of pedagogical theorists and practical educators who look at the school from a *sociological* standpoint, as something between school (as a social institution) and society, or between school and state or home. To-day there is in pedagogy a great struggle for life, a struggle not merely in literature but in practical life, between pedagogical socialism and pedagogical individualism.

II

What is the nature and origin of *Social Pedagogy?* In the middle of the 19th century pedagogy began to take up a social point of view; the point of view of the individual was ignored as superfluous. According to some sociological textbooks, the individual does not exist; an individual man is a mere abstraction. These ideas had a great influence on the theory and practice of education. The social pedagogues reasoned as follows: As man is a social being, and if isolated from society tends to imbecility and extremes in development, social interaction is thus decidedly educative and the social spirit, social activities and relationships should enter into and pervade the school. The old, individualistic pedagogy (*Persönlichkeitspaedagogik, Persönlichkeitskultur*), represented by Herbart, Ziller, Rein, Dittes, Dilthey, Lehmann, Paulsen, Payot, Linde, Münch, et al., was now with passion attacked by numerous literary and practical exponents of *social pedagogy* in its various aspects as represented by historical, universal, cultural, collective, democratic pedagogy; political, state, civic or national education; *Weltpädagogik, Proletariatspädagogik, Arbeitsschule, Gesamtschule, Tatschule.* Among the representatives of this opposition are Natorp, Bergemann, Willmann, Seidel, Stein, Scherer, Siefert, Rissmann, Wendt, Hensling, Kobel, Kerschensteiner, Rasser, Baümer, Leser, Franke, Rühle, Grein (Germany); Dewey, Scott, L. Ward, Small, Sumner, Smith, Ross, G. S. Hall, Burnham, Addams, Mead, Vincent, O'Shea, Dutton, Giddings, Ellis, Cope, Jenks, Allin, Ellwood, Carr (America); Letourneau, Elslander, Worms, Durkheim, Defert, Chabot, Coussimet (France); S. de Dominics (Italy); Masaryk (Bohemia); Milovanovich, Miloshevich (Servia); Koshchevich (Kroatia); Yakovenko (Russia); Sandor (Hungary), etc.

In view of the principles of some of these educational socialists the present schools are criticized because (1) school education is too individualistic, i. e., the pupil is isolated from the home and from nature; (2) school education being conservative, like all institutions, the curriculum looks to the past and to the future rather than to the present;

(3) the curriculum is rigid and non-adaptable to varying individualities; (4) the curriculum is more aristocratic than democratic, i. e., it is highly specialized, one-sided, and narrow, not appealing to the needs of the large majority of the people (hardly one per cent of the entire school population ever attains to what is called "higher education"); (5) form is emphasized rather than context; (6) science is abstract and unrelated to living nature; (7) present day current problems appealing to live social interests (religion, politics, etc.), are ejected from the school because of divergence of public opinion; (8) school instruction and school work is individual, allowing of no mutual help, coöperation or emulation on the part of the children; (9) there is but little correlation of school subjects; (10) the parts of the whole system are not articulated, with consequent gaps, overlapping, and waste; (11) the school grades are isolated, making promotion difficult and interlocking of grades impossible; (12) the great waste in the school comes from pupils' inability to utilize their experiences in any complete and free way within the school itself while, on the other hand, they are unable to apply in daily life what they are learning at school; (13) school methods are inherited from the period when learning and command of certain symbols, affording as they did the only access to all learning, were all-important; (14) theory and book culture are taught to the exclusion of practice, i. e., leisure class ideas are taught exclusively to children of foreign parents, thus adding them to the large army of incompetents; (15) pupils learn mere trivialities instead of that which has meaning and which enlarges their horizon (the school has been so isolated from the ordinary conditions and motives of daily life that the place where pupils are sent for mental discipline is the one place in the world where it is most difficult to get experience, because it is only a place for learning lessons which have an abstract and remote relation to some possible living to be done in the future); (16) while leaders of old educational individualism are talking of "culture," "moral character" (even in children of elementary school and kindergarten age)[1] the development of "personality," etc., as the end of school education, the bulk of those who pass under the tuition of the school regard it only as a narrowly practical tool with which to earn bread and butter enough to eke out a restricted life. REGENER (61) says that "*Der Mensch lebt von der Gesellschaft er muss auch für die*

[1] The creed of the Herbartians, especially those in Jena, is that school instruction is of value only as it educates, and that the teacher is the school.

Gesellschaft leben" (p. 81); (16) that our present school is *"Lernschule"* or *"Sitzschule"* (W. A. Lay), and *"die Schule der Zukunft"* ought to be *"eine Arbeitsschule"* (Seidel).

III.

But scientific (autonomic) pedagogy must, if it would not be handicapped, ever seek for the truth, and the truth only, with a clear, well-trained eye, and the mind's "retinal field" cleared of all floating specks. Space does not permit us to examine the details of all the problems in social pedagogy. We will touch the main problems, with special reference to the chief representatives of social pedagogy. What is the *scientific* basis for their dogma of social education? They all aim to be scientific in their work, but all do not follow the same method. There are at least four different methods:

(1) Natorp (51) bases his social pedagogy on critical philosophy, neo-Kantianism, using the *deductive* method. In the Kantian maxim, "Always act so as to use humanity, in your own person as well as in that of others, as an end and never as a means," he believes we must acknowledge the solution of socialism as an ethical ideal. Pestalozzi,[2] too, who also recognized the close relation between the social problem and true human culture, has been to him a seemingly inexhaustible source of inspiration. Natorp's demand for a national school points back to Plato and Condorcet. According to him, in Plato's social pedagogical idea of the State we have the classical concept of that indisputable truth "that while community, on the one hand, presupposes human culture and is conditioned thereby, on the other hand, community conditions and determines human culture." Natorp claims that the school is the state in miniature and thus serves the purpose of accustoming the school child to the social orders, and that for that reason the school must appropriately conform to public life and be organized as a national school, i.e., the aim of education is socialization. According to him education, the nucleus of which lies in education of the will, is conditioned by the life and organization of the community. He thinks that from this principle the whole content and method of school education can be derived. In one of his articles Natorp claims that the community is indissolubly identified with individuals, just as the individuals are ever part and parcel of the community, or in his own words: "The determining factors of education are found

[2] He was also the immediate predecessor of eminent men of the eighteenth century with pronounced social pedagogical tendencies, e.g., Fichte. ("Addresses to the German nation.")

in the community; the determining factors of the community are found in education." (Die Deutsche Schule, 1908, Vol. 12.) Natorp's social pedagogy rests on a constructive metaphysics showing how it often issues in and rests upon vacant generalities and erroneous affirmations.

(2) BERGEMANN (9-10) claims that he employed the *inductive* method in basing his social pedagogy, ignoring both the deductive method of Natorp's social pedagogy and the speculative individualistic method of the Herbartian pedagogy. According to his "empirical" social pedagogy man becomes a man only through human society, "a single (individual) man is only an abstract concept," there is no such thing as "education without community"—"*nur als soziales kann Erziehung ein sinnvolles Tun genannt werden.*"[3] It seems to us that he makes a confusion in using terms. When he says that the individual does not exist, but only community; that an individual man is a pure abstraction, and community a real thing, he forgets that the term "abstraction" has a double meaning: (a) abstraction means ignoring concrete conditions in observing concrete facts (objects and phenomena); (b) it means the process of formation of abstract logical concepts. The error in his social pedagogy consists in confusing these two meanings of the term "abstraction." The summation of pure phenomena cannot make anything real. According to Bergemann society is real, and the individual only phenomenal. The mistake of logic here made is apparent. It is apparent in Bergemann's treatise that it often rests only on constructive metaphysics.

(3) WILLMANN (89-91) using the *historical* method (colored by the Catholic point of view) gives a conception of civilized life which is to supplement not only egoism but also altruism (social sympathy) by an appreciation of social associations. He says that with the inheritance of material wealth from one generation to another there is also a transmission of the *fundus instructus* of the cultured life, a mental inheritance from one generation to another. Accumulated traditions and stores of knowledge are transmittable, and this we receive without our knowledge or will, though the in-

[3] In the introduction of his "Sozial-Pädagogik" he claims that "Der Mensch wird zum Menschen allein durch menschliche Gemeinschaft," that "Jedenfalls ist uns der Mensch in der Erfahrung stets gegeben als ein soziales Wesen," that "der einzelne Mensch nur als abstrakter Begriff denkbar ist," that "der Mensch ohne menschliche Gemeinschaft besteht überhaupt nicht." He claims that Ziller's individual pedagogy is wrong when it says: "Der Einzelne muss erst für sich einen Werk erlangt haben, ehe er in Beziehung auf die Gesellschaft betrachtet werden kann." (Allgemeine Pädagogik, III, p, 25.)

fluence of hidden social forces, such as social condition, race, manners, political institutions, religious creeds, etc. According to Willmann's social pedagogy, the possessions which are transmitted by means of education and instruction represent not mere collections of separate entities, but rather organic forms endowed with inherent life, and the most minute details of educational theory must be imbued with this idea.[4]

(4) *Psychological method* is employed, for example, by SCOTT (68-70) and ELLWOOD (24-25). According to Scott the school is something more than a mere extension of the home. He claims that the school ought to be "a social combination, with social feelings, sentiments, and needs of its own. By constituting it at all, society has constituted it as a social organism, certain to produce definite social changes in * * * its members." His social pedagogy claims that the transition between work and play is a continuous transition, and if we are to show pupils and humanity not only how to work but how to live, we must extend the values of *free creative* and *social* effort into all our work and, therefore, the transition should be present in every school grade and at every year. According to Ellwood the purpose of education is to adapt individuals to their social life, to produce the good citizen before the good lawyer, physician, engineer, or any other professional type; i.e., good fathers, good mothers, and good neighbors. So much about the *theoretical* side.

[4] In his "Didaktik als Bildungslehre" (Vol. 1) he says: "Die Gütervererbung, wie sie durch das Erbrecht geregelt wird, ist ein weiteres Band, welches die Generationen verknüpft und die Kontinuität des sozialen Schaffens aufrecht erhält. Durch sie überkommt das nachwachsende Geschlecht gleichsam den fundus instructus des Kulturlebens, die materielle, aber geistig verarbeitete Basis zur Fortführung der geschichtlichen Arbeit." (Introduction). Or: "Fortpflanzung und Vererbung, die Pflege der Nachkommenschaft, die ungenwollte Angleichung der Jungen an die Alten, die erbliche Uebertragung der Gütter, die bewussten, mehr oder weniger planmässigen Einwirkungen durch Lehre und Zucht: dies sind die wesentlichen Vorgänge und Akte, in welchen sich die soziale Lebenserneurung vollzieht." (p. 13.) On p. 28 he says: "Pädagogik und Didaktik sind dadurch zu Wissenschaften zu erheben, dass ihr Horizont ausgedehnt wird auf die grossen Kollektiverscheinungen, in denen die erziehende und bildende Tätigkeit der Menschen Gestalt gewinnt, und dass sie auf diese Weise mit Untersuchungen in Verbindung gesezt werden, welche auf die sozialen Phänomene im einzelnen und im ganzen gerichtet sind," or: "Mit der Forderung, Pädagogik und Didaktik auf die sozialen und kollektiven Erscheinungen ihres Gebietes auszudehnen, ist auf das engste die andere verbunden, ihren Horizont zugleich nach Seiten der *Geschichte* zu erweitern, ja beide sind nur verschiedene Auffassungen eines und derselben Princips.' (p. 53.)

IV.

The *practical* side of social pedagogy may be illustrated by the following authors: (1) DEWEY (20-21) gives some idea of what a socialized education would be like. In his Chicago University "experimental" elementary school (founded, 1896; ceased, 1904; at the beginning with only fifteen children, and after three years with about 100 pupils) he tried to organize the school as an "embryonic society," to bring it into closer relation with the home and neighborhood life, and to introduce subject-matter in history and science and art, that should have a positive value and real significance in the child's own life.

He tried to find out "experimentally" the "construction of a course of study which harmonizes with the natural history of the growth of the child in capacity and experience. The question is the selection of the kind, variety, and due proportion of subjects most definitely adapted to the dominant needs and powers of a given period of growth, and of those modes of presentation that will cause the selected material to enter vitally into growth. We cannot admit too fully or too freely the limits of our knowledge and the depths of our ignorance in these matters." (21, C, p. 107). "Schooling" was assimilated to the ordinary course of life outside the school walls, not from pure utilitarian motives, but from the conviction that "it is through the social agencies that the child recapitulates in a few short years the progress which it has taken the race slow centuries to work out." (Ibid, p. 110). There were three main lines regularly pursued: (a) shopwork with wood and tools; (b) cooking, and (c) work with textiles (sewing and weaving). Reading, writing and figuring were taught only in connection with every-day experience and occupation as the background of these three main lines and in definite relation to other school studies of more inherent content, paying individual attention to pupils. This was secured by small groups, eight or ten in a class, and a large number of teachers supervising systematically the intellectual needs and attainments and physical well-being and growth of the pupils. The course began in a kindergarten for children not yet six years old. Their learning revolved about the familiar experiences of life in the home. The usual school subjects were progressively introduced into the studies of the older pupils, but not as such. Dewey and the teachers of his school educational laboratory regarded the ordinary school course as having its main value for the teacher rather than the school child, in that it served as a systematic and logical

statement of human culture which would enable him to ascertain "the environment of the child." The history of culture and of institutions was, therefore, regarded as an indicator of the kind of activities which should be progressively encouraged as the children advanced in school age. Local geography and history formed the core of the studies to which reality was given by handwork with tools, sewing, weaving, cooking, and camping out. And through the various social media included in the practical experiences of pupils, instincts were aroused and given play; and these through their proper activity would, it was thought, lead the child to the next stage in his psychical and moral growth, according to the principle of "initiation in the child's own impulse and termination upon a higher plan." The principle of Dewey's pedagogy is the principle of the Herbartian "psychogenetic law." The only difference is that the guiding principle in Ziller and Rein's selection of material of instruction is "*Gesinnungsunterricht*" or "*Charakterstärke der Sittlichkeit.*" It is apparent that the historical cultural epochs theory of both Herbartians and Dewey is only a misuse of the so-called biogenetic law of Haeckel.*

(2) Riordan (8) made an attempt to unite more closely for mutual interaction the school and society in the Greenleaf Public School of Washington, D. C., whose principal he was. A school garden five feet in width and skirting the inside of the schoolyard fence gives expression to the conscious corporate activity of the school. The entire work is done by the pupils, community ownership and activity lasting till harvest time. Flowers and vegetables are raised, which are divided and used in the school; the pupils voluntarily keep off the garden in their play. Then two courts of sixty feet square have been improved and fitted up by the pupils for playgrounds. They are shaded by awnings and are provided with swings, seesaws, benches, sand piles, gymnastic apparatus, etc. All improvements have been made or purchased by the pupils and belong to them as a community. Discipline is left as much as possible to them. These grounds are used before and after school hours and on Saturdays. The manual training has consisted as much as possible of the necessary industrial activities of the school community. The girls have taken care of the halls and recitation rooms as to cleanliness and decoration; actual accounting and bookkeep-

* See also Messmer's criticism of Dewey's pedagogy in his: "*Grundzüge einer allgemeinen Pädagogik und moralische Erziehung.*" *Erster Teil.* Leiuzig, 1909. p. 353 ff.

ing have been necessary. Reports, programmes and announcements are typewritten and copied on a mimeograph. Telephone and electric bells are put in and kept in repair. Actual painting and carpentry are taught, the buildings being thus kept in constant repair. A monthly paper is edited and published by the children. A savings bank, paying interest on deposits, is also officered and managed by the pupils. A vacation school has been established (the morning hours being devoted to a variety and combination of academic and industrial work, and the afternoon to the playground, with an hour's programme for music, recitations, etc.; the afternoons have been open to the parents, and members of the professions and trades have given simple talks on their respective industrial activities; Saturdays have been used for country excursions).

(3) KERSCHENSTEINER (38-39) suggests a programme of civic nurture for Munich's schools, which will, he says, influence social life in the State, and which may be profitably incorporated in the work of the schools: (a) common work with the feature of division of labor; (b) the articulation of each one's work into some great economical plan; (c) general self-direction, with voluntary subordination of all to the recognized authority of the co-operating group. He has many followers as well as strong opponents, e.g., Weber (82).

The ideal school of the *practical* social pedagogues includes many sane suggestions: (1) school gardens, laboratories, and shops, offering good places for co-operative work (a class of forty-eight pupils, e.g., could be divided into twelve groups of four each; to one of these groups could be assigned the determination of the specific gravity of lead; one pupil weighs, another reads and records the weight, a third checks the work of the first, the fourth checks the work of the second; these roles could be shifted until the work of every pupil is verified by the group); (2) a complex industrial museum, having samples of materials in various stages of manufacture, and the implements, from the simplest to the most complex, used in dealing with them; (3) a collection of stereoscopic photographs and moving pictures illustrating the landscapes and scenes from which the materials come, their native homes, and their places of manufacture; (5) samples of the more perfect forms of textile work (foreign and domestic); (6) objects illustrating motives of designs and decoration which have entered into their production; (7) literature, school library, music, etc.; (8) school nurses, school excursions, vacation schools, school moving pictures, school festivals, school theatres, to teach children, school republics for

training children in civic ideals, school baths, school lunches, school care committees, school clubs, juvenile courts as a part of the school system of the country, school clinics, poultry raising as a school occupation, child labor agencies, school lunches, child welfare agencies, etc.

V.

Social Pegagogy is growing every day, especially in Europe. Its theoretical side may not be always pedagogical, but its practical side will certainly help our present quasi-pedagogical school system, which is paralyzed by the almost daily clash between educational aims (ideals) and school practice. Let us hope it will give us a strong stimulus for a better and prompter investigation of the weak sides of our present school life, which is objectively criticized in the last chapter of G. S. Hall's Educational Problems. (1911, Vol. 2.) Of course, the present ideal of social pedagogy (adaptation of the child to the present social fabric) unduly emphasizes narrow specialization, i.e., a training for existing needs and demands, as though society represented static and fixed conditions. Considering the psychological nature of the child, and his social needs, the main problem is what *can* we do in social training, rather than what *ought* we to do, viewing education from an ideal point of view, as surveying the present and charting the future. We believe that the most economical education will be reached when social pedagogy perforce awaits the development of scientific individual pedagogy as presented by G. S. Hall, Meumann, and W. A. Lay, and then serves to supplement it. Only then may we get a fairly satisfactory *Schule nach Mass,* or, as the late Binet called it, *l'école sur mesure*—the school after measure.

The social aspect of pedagogy is important, but subordinate: the individual pedagogy and individual psychology is, on the whole, more important than social pedagogy and social psychology. Society, not the individual, is an abstraction. Of course we must study the social milieu, occupation, the effects of wealth, country and city, co-education, confessional schools, the development of concepts in the child mind, comparatively and statistically. This is in some degree social. The group as a stimulus for individual work is studied by Meumann, Meyer, Schmidt, Mead, Hartson, Tripplett, Féré, Burnham, et. al. This is also in some degree social. But these facts are of secondary importance. The relation between teacher and pupil is the prime factor in all school education. This relation is an individual one—a relation between individual and individual. Of course this re-

lation may later take into account the community, but first and foremost the relation is purely individual. President Hall (31) is right when he says that educational methods must look forward, not to the present, but to the future society through a full and wide development of the individual. And these methods must be based not on quasi-psychological principles (Herbartian's formal steps; Dewey's conception of the history of culture and of institutions, and pupils' ability and interest), but on the individual psychology of pupils and modern logic. A pupil of Meumann, Dr. Oskar Messmer, has proved that a sound method of instruction must possess a basis both logical and psychological.

This attitude in favor of an objective—scientific instead of mere subjective-psychological method of school teaching may be illustrated by the following quotations from Messmer's works: The first norm is that "the methods of instruction must be so contrived that the intellectual activities —sense-perception, reproduction and association, thought— lead to results that are *true,* and that the emotional effects harmonize with those which are implied in the intention of the matter of instruction." The second norm expressed as a practical maxim is, "Instruct so that the mental abilities of the child are expended most economically." (*Grundlinien zur Lehre von den Unterrichtsmethoden auf logischer und experimenteller Basis nebst kritischen Bemerkungen über die "formalen Stufen"* von Ziller. Leipzig and Berlin, Teubner, 1905, pp. 12-13). "Now in the individual learner the logical processes are always accompanied by others, the constant attendants on thinking. These are not of a logical kind and do not directly influence the *results* of thinking, but they modify the swiftness and promptness of the thought processes themselves. They are the truly psychological processes which always accompany the learner's thinking. For these the second didactic norm claims attention in the teacher's method. As the antithesis of the first or logical norm, this may be called the psychological. Its claim to consideration may be set forth in a variety of ways. The psychological processes, like the logical, are effected in the mind of the learner. But while the thought obeys the same laws in all men, in general accordance with which universally valid knowledge, i.e., Science, is first possible, the psychic processes are variable not only for different persons, but also for one and the same person. For example, memory differs from man to man, and may acquire notable development in an individual; and so of the other processes named. The psychological processes vary with age, sex, person, with

external and internal conditions. Were this the case with thought, science would be in a bad way. It is generally agreed to call whatever so changes, subjective. The term may be applied to these psychological processes. Thus the concept 'subjective' stands as the converse of the concept 'objective,' appropriated to the logical processes. The former expresses the variable, the latter the invariable and permanent. Beneath all their differences, the psychic processes possess, each for itself, an especial didactic interest, which changes from person to person and thus characterizes the individual. Therefore the teacher, bound to respect the variability of mental processes, must study accurately the psychic habit of the individual. The psychology of the individual is for him a leading sphere of observations. Strictly one ought to say, the psychology of the individual *learner,* if the didactic standpoint in question is to be rightly indicated. The battlecry, Respect the individuality of the pupil! is so frequent upon all lips that little which is of importance on that head remains unsaid. Yet even that little will show how many hitherto unrecognized problems lie before us to-day in that quarter. Just as method, so far as it belongs to the first norm, concerns itself with the learner in general, so the second norm principally requires attention to particular mental habit. For the discovery of logical methods, the point of departure is an inquiry into the methods of research, for these must contain the principles followed in the development of knowledge generally. But for the discovery of appropriate measures in the treatment of the pupil quite another auxiliary is needed, and a reliable one exists in psychological-didactic experiment. As for customary experiences, only such of these can be utilized as approximate to experimental exactness. But we must not be imposed upon by the expression Experimental Didactics. It must be said that the whole of didactics reposes upon an experimental basis. That is true only so far as purely psychological processes are in question; logical methods are the result of a purely logical investigation concerning the growth of knowledge. It is, therefore, wide of the mark to set forth all didactics as experimental, as Lay has recently done. The different claims of the two norms upon the teacher may be still further enunciated. The first or logical norm advances measures for the construction of new knowledge; the form of all scientific knowledge is the judgment. But the measures contrived by the second or psychological norm do not lead to new knowledge; their end is not a new branch of science. What they produce in the learner's mind is not a judgment, since

every judgment results from *logical* method. The teacher's psychological measures simply endeavor to obtain swiftness and promptness of thought or of other processes; their purpose is the greatest economy of energy and of time. Methods, so far as they belong to the logical norm, treat the subject-matter in accordance with its scientific-objective nature. So far as methods belong to the psychological norm, they treat the pupil in accordance with his psycho-subjective nature." (Ibid, pp. 154-157.)

VI

To conclude, there may be many pedagogical facts which cannot be solved and are not even touched by social pedagogy —all those problems which arise from the child's psycho-physical nature. Social pedagogy can never serve as a substitute for individual pedagogy. Social pedagogy alone cannot solve the perplexing problem of school education.

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AN INVESTIGATION OF THE FUNCTION AND USE OF SLANG

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This topic was suggested by the Department of Education of the University of Wisconsin as a study of the use and value of slang as a means of expression. It occurred to me that an investigation in which this study could be made definite and specific might yield results suggestive and worthy of serious consideration.

Attention was therefore directed to an investigation of the slang used by the boys and girls of the Madison High School. The following directions were prepared, a copy placed in the hands of each one of the sixteen room teachers, and the work completed in a regular twenty-minute general exercise period:

1. Write your name, age, sex, class, room number.
2. Write as many slang expressions as you know.
3. Tell why you use slang.

Probably from five to seven minutes were consumed in passing papers, in giving instructions to the pupils, and in getting down to business; so that each pupil wrote from ten to thirteen minutes on the topic. I observed the work in one room carefully and think it was done fairly conscientiously. I gave the test without previous notice to the pupils in order that there might be no consultation among them. It occurred to me that such slang words and expressions as were written down on the spur of the moment would be those with which they were quite familiar and would indicate fairly well the slang vocabularies of the boys and girls who participated in the exercise. Probably very few wrote all the slang expressions they knew in so short a period.

As there were only a hundred Seniors in the High School, and for purposes of convenience and comparison, I selected one hundred papers at random—fifty boys and fifty girls—from each of the three other classes. I then arranged the expressions in alphabetical order on large sheets of paper so that one could see at a glance what sex or class used each expression and how many times.

Omitting a few expressions of profanity and some grammatical errors, there were nine hundred and nine different slang expressions. Of this total number the boys used 691

or 76%, the girls 516 or 57%, making the curve of distribution $33^1/_3\%$ greater for the boys than for the girls. Five hundred and sixteen or 57% of these expressions were used but once. Three hundred and ninety-three or 43% of the 909, were used more than once. Adding together the total number of different expressions used by each class, I find that the Freshmen used 43%, the Sophomores 34%, the Juniors 40%, and the Seniors 37% of the total number. Now comparing the number of different slang expressions used by the boys of each class with the number used by the girls of the same class, we find that the curve of distribution of slang expressions for the boys is 18.7% greater than the curve for the girls in the Freshman Class, 19.1% greater in the Sophomore Class, 28.6% greater in the Junior Class, and 40% greater in the Senior Class, showing a gain of from 18.7% to 40% of the boys over the girls in the four different classes, and a total gain of $33^1/_3\%$ for the 200 boys over the 200 girls.

Proceeding with an analysis of these expressions, I do not pretend that my classification is final. It is based on usage with special reference to the character of feeling or thought or both expressed. Some of the expressions seem to lap over from one group into another and again viewed from another angle it seems to me other classifications might be made. Classifications and examples follow:

1. *Modified profanity* (77);[1] A. Variations of the "damn" idea originally perhaps calling down from the Deity severe condemnation, but now much modified and possibly possessing but little of the original force and feeling. "Damn" (8), "cuss it," "ding bust it," "dang it," "darn the luck," "darn" (68), "dog on it" (31), "cuss the luck" (7), "curses" (7), "golly" (41), "gosh all fish hooks," "gosh" (58).

B. Condemnatory oaths with by—"by Hector," "by hen," "by Hecke," "by George," "by Jove," "by Gad," "by H——," "by the great horn spoon," "by Hawks."

C. More strong language prefaced by "Go to," "Go to thunder," "Go to the dickens," "Go to the bow wows," "You go to."

D. Strong exclamations—"Gee, oh gee" (122), "gee whiz" (87), "Jimminy" (25), "Jimminy crickets" (20), "Jimminy bullfrogs" (1), "jiggers" (24), "crimminy" (5), "Jimminy Christmas" (5), "Oh Glory" (2).

2. *Disapproval and disgust* (76):—"shucks" (9), "fiddlesticks" (11), "rats" (18), "piffle," "punk" (10), "rotten" (13), "beans" (3), "shoot it" (2), "Oh ring it" (1),

[1] Numerals indicate number of times each expression is used.

"oh pickles" (30), "Oh prunes" (4), "Oh slush" (26), "Oh put" (12), "Plague the luck" (1), "rank" (2), "bum" (5), "Oh fudge" (47).

3. *Approval and familiarity* (28):—"bully" (7), "game" (2), "you're a brick" (2), "its a dandy" (3), "hummer," "shark" (1), "nifty" (4), "peach" (12), "peacherino" (1), "pippin" (9), "great dope."

4. *Ridicule and contempt* (185):—A. "mutt" (50), "bonehead" (30), "guy," "you carp," "you're off your perch," "he's yellow" (1), "high brow," "tight wad," "grafter," "hayseed," "hot air artist," "rube," "tough nut," "chump," "peanut."

B. A special class in this group expresses the idea of "shut up" or "stop"—"cheese it" (41), "cut it out" (162), "shut your beak" (4), "subside" (2), "come off" (10), "choke it" (1), "cut out the ruff" (2), "drown it" (2), "ring off" (12), "souse it" (7), "button your lip" (4), "forget it" (35).

C. Another division is a rebuke to pride with the notion of "get out," or "fade away" (18), "beat it" (164), "get under the stove" (3), "skidoo" (133), "take a sneak" (11), "go on" (6), "scat" (8), "beat it while the beating is good" (16), "come off your perch" (11), "hit it up" (1), "Go jump in the lake" (3), "vamoose" (7), "Aw forget it" (2), "expire," "mosey along" (3).

5. *Head* (14):—"dome" (1), "solid ivory" (3) "sorrel top" (for red head), "cocoanut" (1), "ivory dome," "round head," "baldy," "bean," "caddy" (for hat), "lamp" and "lantern" (for eye), "phiz" (for face).

6. *Shocks* (4):—Wouldn't that "jar," "frost," "cook," "cork," "stump," etc., you.

7. *Exaggeration and emphasis* (49):—"whopper" (2), "swell" (4), "fierce" (2), "great," "bet your life," "no chance" (18), "Believe me" (14), "you bet" (8), "hot dog" (3), "humdinger" (2), "booster" (2), "splendiferous" (2), "stunning" (2).

8. Variations of the "some" idea (13), expressing quality,—"some girl," "some kid," "some class," "some hat."

9. *Great astonishment* (63):—"great Scott" (10), "great guns" (7), "goodness gracious" (17), "gracious sakes alive" (2), "good grief" (4), "great Caesar" (2), "Holy Smokes," "My Heavens" (6), "For the love of Mike" (6), "For Heavens sake" (9), "My stars" (2), "Well I swan" (1), "For Pats' sake" (7).

10. *Confusion and discomfiture* (10):—"Well, I'll be

switched" (2), "all balled up" (4), "I'll be jiggered" (3), "I'll be hanged" (3), "hard luck," "got it in the neck."

11. *Figurative expressions referring to.* A. Study (16) —"bone" (2), "buck" (16), "cram" (3), "grind" (1), "conned" (6), "canned" (11), "flunk" (26), "stunt" (8), "fusser" (31), "stab it" (6), "crib" (1), "fussed" (5),

B. Objects (22)—"pill" (cigarette) (3), "hoofs" (feet) (1), "gang," "grubhouse," "dough" (money) (2), "bits" (shillings) (6), "bones" or "bucks" (dollars), "fan," "lid" (hat), "chocolate drop" (negro), "cop" (policeman).

C. Actions (36)—"hand over the goods" (1), "deliver the goods" (3), "come across" (11), "pinched" (arrested) (2), "froze out," "bit" (fooled), "balled out" (9), "shell out" (3), "dig up" (2), "all in" (3), "come again," "make good" (2), "cuts no ice," "go to it" (2), "sponge," "stickaround" (3).

12. *Fighting* (23) :—"whack him" (1), "knock his Rover off" (1), "jump on him" (1), "biff" (4), "beat him up" (2), "swat him" (2), "slug him" (2), "soak him" (4), "poke him in the slats," "wipe him up."

13. *Intoxication* (10) :—"full" (1), "piped" (4), "tight" (11), "half stewed" (1), "has a skate on" (1), "loaded" (1), "booze" (1), "half shot" (1), "eye opener" (1).

14. *Insanity and stupidity* (28) :—"daffy," "batty," "dippy," "you're bughouse" (4), "off your trolley," "screw loose," "mutty" (1), "bats in your belfry" (1), "muttonhead" (2), "off your base" (3), "you're a bonehead," "You're a mutt" (6), "you're dingy."

15. *Negation and denial* (9) :—"naw" (2), "nix" (3), "nuff said," "not on your life" (4), "nit," "nothing doing," "not much" (2).

16. *Urgency* (4) :—"Up to you" (7), "down and out" (1), "up against it" (7), "dead broke."

17. *See, look or understand* (12) :—"Pipe the lid" (7), "rubber," "get on to" (1), "catch on" (2), "pipe the hat" (2), "get next" (1), "get wise" (5), "catch on to the phiz" (1), "get me?" (2), "dead on" (3).

18. *Miscellaneous* :—"Tell it to Sweeney," "get his goat."

It will be observed that the expressions of dynamic force denoting feeling and emotion predominate. There are 450 expressions of this character, or about 50%. A study of the reasons given by the High School pupils for using slang corresponds very nearly with the classification given above. Two hundred and thirty-eight out of 400, or 60% of them, or if

we omit the 40 who through lack of time or for other reasons gave no answer to this question, 67% of them use slang because it expresses thought or feeling, or both, better. The characterization of their answers, together with the number of times each was given, was as follows:

1. It seems natural to use slang, 15.
2. Because some University professors approve of slang, 2.
3. More appropriate, 4.
4. Use it when angry, 18.
5. Slang is more concise, emphatic, and expressive, 60.
6. Use it to express ridicule and contempt, 5.
7. Slang is more impressive, 50.
8. Slang expresses feeling better, 40.
9. It makes thought clearer, 12.
10. Use it from habit, 74.
11. Carelessness, 5.
12. Expresses thought better, 24.
13. Expresses thought and feeling better, 5.
14. Use it just for fun, 7.
15. Because others use it (imitation), 22.
16. As a substitute for profanity, 6.
17. Because it is manly, 3.
18. Don't know why, 12.
19. No reason given, 40.

Now, taking a number of papers from among those pupils who stand high in their work in English in the High School and comparing these papers with a like number from those pupils whose work in English is of a low grade, we find that the former have written an average of 17 slang expressions while the latter wrote an average of but 10. And again taking a number of papers written by pupils who are representative of little culture in their homes and comparing them with a like number representative of culture at home we get an average of 12½ expressions in each case. We often hear it said that slang is much more prevalent among people who lack culture and also among those who are inefficient in English, and while the mathematical data of only a few, comparatively, is given here, I feel confident from the study of the subject that these inferences are wrong, and that in many instances the reverse is true; but that on the whole the use and prevalence of slang is not based on the influence of culture or lack of culture at home, efficiency or non-efficiency in the use of English, but rather upon the individuality of the person who uses it.

Conclusions and Discussion

1. The slang vocabulary of the boys of the High School is larger than that of the girls. It ranges from 18.7% larger in the Freshman Class to 40% in the Senior Class.

2. The Sophomore Class used less slang than any other class. The fifty boys of this class used less slang than the fifty boys of any other class. Likewise the girls of this class used less slang than the girls of any other class. This falling below the average of any other class I believe was due to the feeling of restraint caused by a misunderstanding of what was wanted of them.

3. Barring the Sophomore Class the range of slang expressions used drops gradually from 43% of the total in the Freshman Class to 37% in the Senior Class, a difference of 6%.

4. Barring the Sophomore Class, the difference in the number of slang expressions used between Freshmen and Senior girls is 18% in favor of the former.

5. Slang certainly has an important place in our expression, indicative of thought and feeling for which conventional language seems inadequate; and further, slang is one of the sources from which our language is built up. It is language itself in the process of development and providing for its own needs.

6. There are two types of slang, temporary and permanent. Examples of the former are "Well, I should smile," "Where did you get that hat?" "some," and "swell." Most of these expressions drop out of usage as soon as the time or occurrence which recalls or represents them is forgotten. While they do last, some of them become "blanket expressions" or "utility words" for any number of different ideas. Take the use of "some." It is "some class," "some professor," "some play," "some" everything. Likewise, the use of "swell" is prostituted and made a scapegoat for lack of thought in too many instances. We have "swell show," "swell professor," "swell lesson," "swell" all along the line until one is disgusted and comes to the conclusion that it is really not "swell" anything, but rather an indication of inability on the part of the user of these expressions to clothe his thought in proper language, or else pure laziness. I believe there is less reason to criticise the small boy in this particular than his elders. For if there is any one on earth who is master of the language of contempt and ridicule, it is he. He does use utility words, but not to the extent, perhaps, that his elders do. I have actually seen a dozen grammar school boys, with their volleys of slang expressions indicative of

contempt and ridicule, put a bunch of rooters for a college foot-ball team off the bleachers. Their language of contempt is unmistakably dynamic; it goes right home and hits the mark. The other day three small boys were interfered with while coasting by a larger boy. "You're a mutt!" said the eight year old. "Paste him in the eye!" said another. "Let's knock his block off!" said a third. "Beat it, or we'll pound you!" was another cry. Is there any doubt in any one's mind but that these bursts of unconventional language are an exhibition of dynamic feeling, anger, and contempt which had to find expression in some exceptional way, some manner out of the ordinary, in order to satisfy? Is not this language effective? Does it not hit the mark? Were not these boys efficient in expressing both their thought and their feeling, and was it not effective as to results? (The big boy took to his heels.) Witness the exclamations of pleasure and approval of two boys reading the handbill of the Union Vaudeville: "Whew!" "Hot stuff!" "Goin' to be a hummer!" "gosh!" "goin'?" "You bet!" Perfectly natural, too, it seems to me. Would any one have these boys use the conventional language of adults?

The theaters are hotbeds of temporary slang. Expressions such as "mascot," "hoodoo," "skiddoo," "wipe off your chin," have come from there. Others originate in the trades and professions, and by a process of filtering some of them come to be good English. The words Puritan, Quaker, henchman, boss, boomer, boom, blizzard, stunt, crank, fad, hobo, swell, and flunk, are examples of words that have come into good usage through the school of slang.

There are many expressions, figurative in character, which might be termed permanent slang in contrast to the mass of ephemeral stuff that is constantly cropping up and dying out. Examples are "up against it," "win out," "square yourself," "up to you." These expressions are not only effective, but give force, color, and life to language. Expressions of such character will be used as long as we as a people are growing and changing; for the language must meet the growing needs of the people who use it. And new expressions that meet the needs of the people and stand the test of usage are sure to be passed up to the goal of good English, while those which do not will drop out. And finally, to summarize my justification for the use of slang: 1. Slang is often permissible when it is more effective and goes to the mark better than conventional language. 2. When it is better adapted to express feeling and emotion. 3. When it makes thought clearer.

SOME EUROPEAN INSTITUTIONS FOR THE PROTECTION OF MOTHERHOOD AND THE PREVENTION OF INFANT MORTALITY

By Theodate L. Smith

It is only within the last few decades that the protection of motherhood has been recognized as an economic principle. Until well on in the nineteenth century the only law relating to motherhood was the one which forbade the execution of a woman with child. But with the wider entrance of woman into the industrial field and her increasing economic importance sociology has begun to recognize the fact that in the protection of the mother lies the welfare of the nation. In Europe, where national competition for supremacy and perhaps even for survival is a very real question, and where men are needed to supply the army as well as for industrial pursuits, movements to prevent the wastage of infant life are becomingly increasingly prominent. Since the welfare of mother and child are inseparable and but two aspects of the same problem, we sometimes find the emphasis laid on the care of the mother during pregnancy and immediately after childbirth and in other cases it is the care and hygiene of the child that is stressed. France, perhaps because of its alarming standstill of population, was one of the first countries to initiate movements for the protection of mothers and prevention of infant mortality. One of the earliest of these institutions was a private philanthropy called the *Allaitement Maternal,* founded by Madam Bequet de Vienne in 1876. Its aim was to help women who nursed their children, to provide them with food, milk, medicine, clothing, and layette for the baby when needful. This was recognized by the government as an institution of public utility in 1880. It has a corps of volunteer visitors who investigate the needs of mother and child and if the conditions are such that aid can be given in the home, this is furnished. But as many of the homes are so poor as to make even the minimum of care and decency impossible, appeal is often made to the *Ligue des Mères des Familles* which coöperates with the *Allaitement Maternal* which has two refuges for pregnant women as well as a convalescent home for women leaving the maternity hospitals. These homes receive the mothers three or four

months before the child is born and furnish them with sewing and other occupations as far as they are able to work. The women go to the maternity hospitals for confinement and are received at the convalescent home on leaving it. The *Allaitement Maternal* also has a free canteen where nursing mothers may receive a free meal if unable to pay for it. This institution has now several branches in France and over 45,000 children have been aided since its foundation, while over 14,000 mothers have received the benefit of the refuges and nursing homes. As free hospitals are far less frequent in Europe than in the United States the hardships of the very poor during maternity are correspondingly greater and these two institutions have supplied a very pressing need.

An institution of a somewhat different order, the *Consultation de Nourrissons,* was organized in 1892 by Dr. Pierre Budin, Professor of Obstetrics in the University of Paris. This was the first school for mothers in France, for its object was not only to care for the child but to instruct the mother so that she might continue this care in an intelligent way. The original *Consultation* was established at the Hospital *Le Charité,* under Dr. Budin's personal direction but several others were soon inaugurated and multiplied rapidly so that they soon spread beyond the confines of Paris to other cities. At a time when the infant mortality among the working people of Paris was running as high as 25 and 30%, the mortality at the *Consultation* at *Le Charité* was practically zero, although there were some cases of illness, and everywhere that the *Consultations* were adopted they caused a great decrease in the infant death rate. Breast feeding is always encouraged and insisted upon while the mother is in the hospital, if she is able. As Paris has not yet attained to a milk supply sufficiently pure for babies, sterilized milk is used for bottle feeding when this is necessary.

At the very time that Dr. Budin was organizing the work in Paris, a physician at Fécamp, Dr. Dufour, who knew nothing of the organization of the *Consultation de Nourrissons,* was greatly concerned by the terrible mortality among the babies of his own city. As a means of combatting it he established milk stations called *Gouttes de Lait.* These are essentially the same in purpose as the *Consultations de Nourrissons.* Mothers are furnished at these stations with suitably prepared or modified milk when the natural supply is insufficient or lacking, but are always urged to nurse their children if able to do so. Gratuitous consultations are held to which both sick and well children are admitted. If a baby is not gaining in weight as it should, it is promptly placed

under medical care and the mother followed up as far as possible to see that she carries out directions, which is the most difficult part of the work, for ignorance often baffles science and while it may be scientifically demonstrated that a bottle with a rubber tube is a deadly instrument and directly poisonous to the baby, it is frequently impossible to convince the mother that the illness and death of her children are not directly due to the hand of Providence rather than to preventable causes. Before the establishment of the *Gouttes de Lait* at Fécamp the death rate for children under one year averaged from 21% to 23% but has, by its agency, been reduced one-half. Investigations on the causes of death among infants have shown that pure milk or even breast feeding are not the only remedial factors that must be invoked. The mothers coming to the *Gouttes de Lait* represented three classes: those absolutely indigent who could pay nothing; wives of workmen in fairly comfortable circumstances; well-to-do people, who, finding that the *Gouttes de Lait* babies were thriving, brought their own to receive its benefits. The death rates for the three classes were respectively 20.19%, 9.05% and 5.3%. As all received the same instruction and milk supplies, it is evident that other conditions beside feeding affected the death rate.

The *Mutualitè Maternelle* in Paris was founded by Madam Carnot, whose sympathy was aroused by the extreme poverty and suffering of the working women of Paris during maternity. This was at first limited to the needle and lace workers in whom Madam Carnot was especially interested, but in 1902 the association was extended to include all working women or wives of working men in Paris. It has now extended to other cities and held its first national congress in 1908, having a membership roll of nearly 30,000. There are several classes of members, some of whom simply contribute to the support of the organization. The participating members, as they are called, must be either working women or the wives of working men. They pay three francs a year which entitles them, when confined, to a payment of 12 francs a week for four weeks, provided no work outside the home is done during that time. For every child beyond the sixth, the weekly payment is raised to 15 francs and in case of twins it is 18 francs. For the first three weeks, this stipend is brought by a friendly visitor who is one of the supporting members of the Association. This friendly visitor must herself be a mother and have taken a course of training for this work under the physicians of the *Consultations de Nourrissons.* Bringing the payment, she is a welcome visitor, and usually

makes friends with the mother of the baby, so that she is able to give her a great deal of instruction in regard to the care of her child and perhaps helpful advice as to the care of her home. It is said that this type of friendly visiting is helping to bridge the social gap between classes in Paris and that the association between the visitor and mother is frequently continued after the immediate necessity has passed. For the fourth payment the mother goes to the nearest *Consultation de Nourrissons,* never a great distance, as there are now 55 of these in Paris. If she has nursed her baby during the four weeks she receives an additional bonus of 10 francs. She is encouraged to bring the baby regularly to the nearest *Consultation* during the first two years of its life. Here the baby is periodically weighed and receives medical inspection and advice if any is needed. There is frequently a good deal of rivalry among the mothers as to who shall bring the best nourished and healthiest looking baby and many of them would certainly bear comparison with babies whose conditions of life are far more fortunate. This institution has been introduced into the French Army and there are now five military sections in Paris regiments.

In Germany, scientific investigation is paving the way for philanthropic application.

The *Kaiserin Auguste Victoria-Haus* is an absolutely unique institution and is perhaps best briefly described as a physiological institute whose object is the investigation of all problems relating to motherhood and infancy, with the ultimate aim of scientifically determining the best conditions for the production and rearing of healthy children. In the beginning of the twentieth century the average death rate in all Germany for infants under a year old was 20% of all those born, and in certain regions where conditions were particularly bad, the death rate ran as high as 47%. This high death rate attracted the attention of the German *Kaiserin* and she appealed to one of the existing committees for health and welfare to consider means by which this condition of affairs could be remedied. The result was the *Kaiserin Auguste Victoria-Haus zur Bekämpfung der Säuglingssterblichkeit,* which was founded in 1907. It is situated in Charlottenburg, one of the larger suburbs of Berlin, and has buildings and equipment which cost over two hundred thousand dollars, to which both private individuals and the different states of Germany have contributed and continue to contribute for its support. In July, there were in the institution about forty mothers and eighty babies, there being a department for sick babies as well as for those born in the institu-

tion under normal conditions. In going over the institution we were shown first the dairy where the milk is produced and cared for under the most hygienic conditions. The plant is a model one, fitted with white tiling and complete apparatus for thorough cleansing, for cooling and caring for the milk. It was originally intended that all the milk used in the institution should be supplied from this dairy but at present it is not large enough to meet all the needs of the establishment, so that part of the milk has to be purchased. As the institution is supplied with finely equipped laboratories for research in all problems connected with the hygiene of infancy, this double arrangement though not entirely to be desired, may furnish material for the solution of a double set of problems. Although the aim of the *Kaiserin Auguste Victoria-Haus* is primarily scientific, it is philanthropic in so far that the most needy mothers are selected for the benefits of its care. The original design was to have the mothers in the institution for several months before the children were born and to keep them for some months after the birth of the children, but this has not as yet been found entirely practicable and the mothers as a rule are in the house only about two weeks before the birth of the child, though they are in many cases kept for several months afterward. During that period of residence they are as far as possible instructed in the care of their children and in the simple elements of hygiene. They are always, when this is possible, encouraged to nurse their babies and those who remain for some months also nurse the children in the department for sick and weakly children, due attention of course being paid to any possibility of transferring infection to the healthy children. There is also a school for training children's nurses, modelled after the English schools for "lady nurses." The course of training includes not only practical care of children from the earliest days of life but the preparation of food, making of their clothing, means of entertaining them, and thorough course in hygiene. Each nurse before graduation must assume under supervision for several months the entire care of one child for whom she does everything, including the preparation of food, washing, and mending. There are two classes of nurses the length of training being the same for both, that is, one year, the only difference being that the so-called "lady nurses" are required to speak at least one language besides German, and that they pay 1,200 marks for their course, which is free for the class called simply children's nurses. Both classes receive regular instruction from teachers of the *Froebel-Pestalozzi Haus,* which is the unorthodox kinder-

garten training school of Berlin. In addition to the patients in the house, there is a department for out-patients, to which the mothers are urged to bring their children periodically until they are at least two years old, in order that a record of the development of the children may be kept by the institution. In practice, it has been found very difficult to carry this out as most of the children are illegitimate, the unmarried mothers being the most needy class and their residences change in accordance with their opportunities for work. The ward for sick babies is one of the more recent additions and furnishes opportunity for training the nurses in the care of sick children as well as for clinical observations by the physicians. Here, in the large airy apartments are put in practice all the aids which modern medical research can furnish to transform delicate and sickly children into strong and healthy ones. One plump and rosy cheeked little fellow of nineteen months had been under treatment for tuberculosis, evidently with great success though the physician in charge said that the von Pirquet test still gave a slight reaction in spite of his healthy appearance. In addition to the work actually done in the institution, researches on a great variety of subjects concerning infants and mothers are undertaken and published as completed. The following is a partial list of the subjects of research: Government care of children; Communal care of infants; Foundlings; Birth and mortality statistics; Tuberculosis; Insurance and protection of mothers; Milk depots; Inspection and police regulations in regard to milk; Wet nurses; Midwives; Laws for the protection of children, etc.

The *Zeitschrift für Säuglingsschutz* which is published monthly is jointly the organ of the *Kaiserin Auguste Victoria-Haus* and the *Deutschen Vereinigung für Säuglingsschutz,* thus coördinating the results of the researches of the former with the practical aim of the latter, which is the federation of all of the existing agencies in Germany for the protection of infancy and coöperative work. In addition to this the *Kaiserin Auguste Victoria-Haus* issues at irregular intervals a special publication entitled *Ergebnisse der Säuglingsfürsorge,* in which the results of special investigations made by the institution are published. Although yet a mere beginning of what it hopes to be, the *Kaiserin Auguste Victoria-Haus* has already accomplished excellent work and has every prospect of developing into a center whose influence will be widely felt not only in Germany but in other countries.

In visiting Dr. Miele's *Oeuvre d'Assistance Maternelle* I was giving myself a pleasure to which I had looked forward for some years. Ghent is a city of some 162,000 inhabitants,

largely workers in textile mills, many married women are employed in the factories, hours are long, wages low and the infant death rate correspondingly high. Until about ten years ago more than a third of all the children born in Ghent died before completing the first year of life. In 1901 Dr. Miele set himself the task of devising some means of checking this waste of infant life, due in large measure to poverty, ignorance and oppressive social conditions. His first effort was a free clinic for mothers and babies in which advice and treatment for both sick and well was offered. At first naturally only sick babies, and usually very sick, were brought to him, for why should a child who is not sick be brought to a doctor. But gradually Dr. Miele's purpose began to be understood by the more intelligent visitors of the clinic, though a doctor who wanted to keep babies well instead of curing them after they were sick, was a totally new idea to these poor mothers who for the first time received intelligent instruction as to how to care for their babies. Whenever able, mothers were always urged to nurse their children, but when this was impossible, definite prescriptions for artificial feeding were given. But a new difficulty appeared; it is exceedingly difficult to procure pure milk in Ghent and when procurable, the mothers were often too poor to pay for it. With the aid of the Bureau of Charities, which in Ghent receives municipal aid, a society for helping indigent mothers was organized and through this society, milk is furnished free to those too poor to pay for it. Mothers who have visited the dispensary long enough to learn how to care for their children, visit others of their own class, passing on the instruction and, in time of need, helping those with sick children. The work thus begun developed rapidly and now more than a thousand babies are annually brought to Dr. Miele's dispensary and among these the annual death rate is now under four per cent, for 1910 not quite three per cent. It was with great interest that I went by appointment to a modest little office at 33 *Fossé d'Othon.* Here, side by side, but entirely disconnected stand two houses, one of which is devoted to the clinics for mothers and babies and the other to tuberculous patients. At the first mentioned house, regular consultations are held three days in the week from ten to eleven in the morning and from four to eight in the evening, to which mothers may bring their children for advice. The babies are weighed and instructions given as to their care and prescriptions if they are ill.

Here, too, special health talks, illustrated by lantern slides, are given to mothers, showing the proper method of bathing

a baby and all the various processes in its care and occasionally there are exhibitions of hygienic baby clothes of a very cheap and simple character or perhaps a display of the best cradles or bassinets made of fruit crates and other inexpensive materials.

There is also a training course for foster mothers who, on its completion, are entitled to receive into their care two or three infants whose mothers work in factories. The number of children which one woman may care for is limited and only those holding Dr. Miele's certificate may undertake this work. The babies must be taken weekly to the dispensary where they are regularly inspected and weighed so that they are under constant supervision. After a certain amount of successful service these foster mothers may take charge of one of the crèches when opportunity occurs. From the best of these women, or, in a few cases, from among the young girls, the most successful are selected for special training in nursing skin diseases, incubator babies, etc.

A very important section of the work is a course in child culture given to a limited number of young girls of fourteen to eighteen who act as Dr. Miele's assistants. This consists in a simple course of anatomy and physiology, practical courses in the preparation of sterilized milk and infant foods. Practice in the dispensary work of weighing, making charts and keeping temperature and other records and finally a course in the crèche where each pupil has for a time the entire charge of a baby. As his assistants Dr. Miele selects young girls of fourteen years old as they are leaving school. He lays great stress upon character in his selection of these assistants, for he puts great responsibility upon them after they have been suitably trained to assume it. All of the weighing of the babies, the keeping of records and similar work is done by these assistants. There are no trained nurses in Ghent and in the crèches, of which Dr. Miele has established three for sick babies, the place of the trained nurse is taken by these young girls, an older woman who is a mother herself being in charge. Exquisitely clean, everything in these crèches is of the simplest and cheapest description, Dr. Miele's theory being that there is little practical value in any appliances which are not obtainable in the homes, and as wages in Ghent in the textile factories are only twenty to twenty-five francs per week, the necessity of economy is only too apparent. No nursing bottles are used in the crèches but the babies are fed with a teaspoon, which, as Dr. Miele says, is to be found in every house and can be kept clean, a characteristic which is not always true of bottles. The little cribs

in which the children lie are as cheap as possible but of a construction that can be easily cleaned and kept clean. Even an incubator, in which several premature babies had thriven, was not the ordinary expensive apparatus but a simple construction of Dr. Miele's own devising which cost about four dollars. It consisted of a zinc-lined wooden box, inside of which was a zinc trough, the space between to be kept filled with hot water. There were two apertures, into one of which the hot water could be poured and one for siphoning it out. Here Dr. Miele called my attention to the necessity of choosing his assistants according to character so that each one could be relied upon to follow directions exactly in keeping the water at the right temperature. Even the scales for weighing the babies were not ordinary manufactured scales but a very simple device weighted with shot on one side and the basket for the baby on the other and costing about thirty-five cents. In visiting the house devoted to the tuberculosis clinics I found the same principles of economy carried out. The tuberculosis clinics were a later development than those for infants because Dr. Miele found that after guiding his babies safely through the dangers of infancy and early childhood they frequently became victims of tuberculosis at the ages of nine or ten. Here, as in the other institution, the assistants were young girls trained by Dr. Miele himself. Tuberculin in its commercial form is an expensive product, but Dr. Miele found that by buying the crude tuberculin in Germany and having it prepared under his own direction the expense could be reduced to a minimum. To my astonishment I found that all the tuberculin and lecithin was prepared by a young girl about sixteen years old, whom Dr. Miele assured me was "*ein sehr braves Kind,*" upon whom he could depend to follow his directions implicitly. Besides the clinic and consultation, Dr. Miele and his nurses visit children who are more seriously ill in their own homes and he has inaugurated a system of neighborly helpfulness through which those in one group assist each other in time of trouble. In going with Dr. Miele into the homes one could not but be struck with the implicit confidence with which he was received. When I asked him how long he had been working in this line he answered, "About ten years, and the first five years were up-hill work because the people did not understand what I wanted to do for them. They did not trust me, and worst of all would not obey directions. But now," he added, "I have very little trouble.' And that one could well understand as one watched the brisk, cheery Fleming through his day's work, every moment efficiently used, quick

and authoritative in his manner, but with a heart so big and kindly that there was room in it for every suffering child. When I asked him why he did not write something about his work his answer was, "Oh, I have no time, there are so many sick babies." The work which Dr. Miele has actually accomplished with great expenditure of personal labor has been at a cost in dollars and cents the lowest that I have been able to find in any statistics. His methods should surely be made accessible to others, for he is a modern Saint George fighting the dragons of poverty, disease and ignorance with the weapons which modern science has furnished and which in his hands have accomplished much.

But though Dr. Miele has no time to write of his work its influence has nevertheless extended beyond Ghent for the first school for mothers in England, St. Pancras, was directly inspired by the success of Dr. Miele's work in Ghent. It would be difficult to find a more depressing region than Chalton Street in the district of London where the St. Pancras School for Mothers was founded in 1907. Open stalls, where old clothes, decaying vegetables and malodorous meats and fish jostle each other, roadway and sidewalks littered with decaying refuse, and sodden, hopeless faces on every side, these are the surroundings that greet the visitor to St. Pancras School for Mothers. Never was an object lesson more needed than the cleanliness and neatness of the very plain rooms where the mothers of the region bring their babies to the *Consultation* to be weighed and inspected and to receive advice and instruction for their care, for Dr. Miele's idea of saving the babies by teaching the mothers to care for them intelligently, is the fundamental one. But in England a new feature has been added. English women of the poorer classes have little knowledge of cooking and in London many families live on the products of the fried fish or pork shops, not because of the lesser cost but because of absolute ignorance of nutritive values and the most elementary knowledge of cooking. Moreover when supplies are short it is usually the mother who sacrifices herself often to the detriment of her unborn child, while the nursling suffers from both improper food and insufficient nutrition of the mother. To meet this condition the St. Pancras School proposed to secure the proper nutrition of the baby by feeding the mother and undertook to furnish dinners to pregnant and nursing mothers at 1½d, the actual cost of the food being 2½d. For this sum a substantial dinner of meat, vegetables, and a pudding can be furnished. Great pains is taken not only that the food shall be nutritious but that sufficient

variety shall be secured to render the meals appetizing. In cases of absolute need where the mother is unable to pay even the small amount charged, the London County Council provides a certain number of free tickets. During these dinners opportunity occurs for a great deal of informal instruction, which is frequently the most effective kind. The mother has to bring her baby with her and it is easy to enter into personal conversation with the baby as a mutual subject of interest. Most of these mothers need to be taught even the simple fact that it is needful to keep the baby's feet warm, seeming to consider that it is a rather normal condition for them to be cold, and it usually requires a good deal of instruction to convince a mother that there is any relation between her baby's indigestion and its cold feet.

In connection with the St. Pancras School there is also a Provident Maternity Club to encourage small savings for the time of need and for every shilling saved, a penny is added by the committee, and there are also evening conferences for the fathers, where they are allowed to smoke and are furnished with entertainment. The Home Visiting Department is also an important feature of the work and recently the "pudding lady" who represents a new type of social work has been rendering important service in transferring cooking lessons from the school to the individual homes and giving her practical instructions under the same limitations and the same lack of conveniences under which they must be carried out. St. Pancras School for Mothers was founded in 1907. In June, 1911, there were ninety-seven mothers' schools in Great Britain, varying somewhat in detail, under the auspices of various associations, but all following in principle the example furnished by the first English school for mothers.

INDUSTRIAL SCHOOLS IN GERMANY

The Bureau of Education at Washington has issued the following circular which contains such an excellent brief description of the industrial schools in Germany that we reprint it in full.

December 15, 1911.

CIRCULAR OF INFORMATION No. 2

The marked advance of Germany along industrial lines during the past few years is by common consent ascribed in large measure to the number and excellence of her industrial schools. As a result those schools have frequently been studied by Americans, and a number of excellent descriptions of them have appeared. One of the best of the briefer descriptions appears in the Report of the Wisconsin Commission upon the Plans for the Extension of Industrial and Agricultural Training, which formed the basis of the notable law upon that subject enacted by the recent session of the Wisconsin Legislature. The following is a digest of a portion of the report:

The fact that the Germans are going into the commercial markets and underselling us is shown by cold, dry statistics. German sales in the United States have increased nearly 100 per cent. since 1900; and to the English colonies, South America, China, and the entire world German products are going in a great and overwhelming stream. Nevertheless, your committee does not recommend that we copy the methods of Germany; we can not apply German methods in our work. What appears to the German as superficial in our education is sometimes the basis of that quickness of comprehension, that intuitive insight and readiness which can not be replaced by the tremendous care and ponderous exactness of certain German methods. We must not forget that peoples differ in temperament. The psychology and the general make-up of the people, and the physical characteristics of the country must be taken into account. We must build upon what we already have and add to it from the best of all other lands.

In considering the specific causes of German's educational success in detail, the first point which astonishes us is the heavy investment made in industrial education. Nearly every small village has at least one industrial school, and often in small cities several are found. In Hanau, a place not much larger than Madison, there are 5 industrial or commercial schools, including an industrial art school and also what is practicallly a mechanical engineering school. The equipment of some of these schools is very complete and costly, but in most instances is very economical and surprising simple. The buildings are well adapted to the work in hand. Some idea of the investment can be obtained from the fact that the little province of Wurtemburg, which has a population less than Wisconsin by at least one-fourth of a million persons and which is on the whole a poor, hilly country with very poor transportation facilities, has, besides its splendid system of elementary and secondary schools, about 250 industrial schools in its towns and villages, 1 knitting school, 3 weaving schools, 2 industrial work shops for actual practice in weaving, 2 technical schools for textile and mechanical work, a large State university, technical university,

a royal building-trades school, a great commercial college, several commercial improvement schools, a great agricultural school, many farming schools, similar to county agricultural schools here, an art trade school for industrial art, a pure art school and many miscellaneous schools of all kinds for workmen of various grades, evening schools, continuation schools, etc., including schools in domestic economy for women. The tremendous investment made by this little province is far beyond anything of which we, in our prosperity, have thought.

In one of the industrial schools in Munich, are equipment and workshops in the following work: Electric motive power; electric lighting; locksmith and machine forging; book printing and lithography; cabinetmaking; stucco work; carving; chain making; metal work; plumbing fittings; tinsmith work, and photography. There are in Munich about 60 continuation classes. A great many industrial schools are maintained both by the city of Munich and by the kingdom of Bavaria.

Practical Nature of the Work.—Almost without exception there is in Germany a correlation between the industrial conditions in the cities or towns in which these schools exist and the industrial schools. In fact, it is impossible to define exactly a German industrial school. Each city meets the problem differently. Each tries to adapt the teaching to its own needs and sometimes the curriculum in a school in a certain village is entirely different from that in any other community. The schools are a striking reflex of the industrial conditions of the communities in which they are found. The reason for this can no doubt be found in the gradual growth of these schools and in the masterly way in which they are made to meet the wants of the great masses of the people. Instead of starting with a few costly trade and technical schools the Germans have encouraged a gradual growth in the entire field of industrial education, and they have put the emphasis upon the average man of an industry and the teaching of the average workman at the bench or at the machine. They have realized that the success of an enterprise depends in the long run upon the men in the ranks. They are now putting as much strength into building up the average man—the average workman—as in building up the higher education, although the investment in higher institutions is as great in proportion as ours, if not greater. The technical schools of collegiate grade are splendid, yet it is to the miscellaneous continuation schools that Germany owes a great measure of her success.

Continuation Schools.—Your committee believes that it is the German industrial continuation school which especially deserves study. The German continuation school is made possible by the fact that practically every one is compelled to go to school until he is 14 years of age. From 14 to 18 he is compelled to go to school a certain portion of his time. This would average perhaps a day in a week. He may go to school in some places from 4 to 6 in the afternoon; in other places and other trades, 2 mornings a week, and in still other places (and this is the popular way) he may go to school for 1 day in a week; but he must go to school. The reason for this is the sensible way in which the Germans have studied out a plan for replacing the apprenticeship system. Taking the remnants of that system, which of course still exists here and there, they have added to it the continuation school.

The apprentice in the jewelry firm begins work, we shall say, at 14 years of age. On Friday or Saturday he has to go to school. In that school he may have one hour of German, one hour of free-hand drawing, one hour of plastic design, one hour of commercial geog-

raphy; and in general everything which will give him a broad view of the other departments of the work in which he is engaged. If he is a merchant's clerk, he may be given a course in a mercantile continuation school, which would teach him how to buy and sell, do accounting and to understand the general features of a thorough commercial education. Everything is applied directly to the business in which he finds himself, and which perhaps in his own town or village is a specialty. For instance, the city of Hanau is largely engaged in jewelry work. Instruction in selling jewelry and the manufacture of jewelry is the chief work of the continuation school. Continuous classes are held in most cases so that in the industrial school where boys between 14 and 20 years of age and even men up to 25 or 30 go to school from 2 to 4 years to learn trades; there are also many boys coming in every day of the week from different manufacturing establishments. Evening classes are also held, but if a boy goes to an evening class, the manufacturer is compelled to allow him a certain number of hours each day away from his work, so that the total number of hours for the evening school and day work is not greater than one day's work. This is also the law in Scotland. The classes are small in these schools, and the "task" system is so used that a class may include one boy who is doing very elementary work, and another who is finishing the highest task given by the teacher.

In the beginning only a few of these classes were organized as the need became evident. There always remained boys in unskilled or miscellaneous work. General continuation classes were founded for them, and as courses could be provided for special trades or pursuits, separate courses were instituted for such trade or pursuit. Those who remained in the general courses were given general manual training, literature, arithmetic, citizenship, etc. Schools of like nature exist for girls, and special classes have been rapidly organized in the different work in which the girls are employed. Above the continuation course are a great variety of schools—lower industrial schools, middle industrial schools, higher industrial schools, and special schools of all ranks and descriptions, apparently not strictly classified and differing in curriculum and standard from city to city and from division to division of the empire, making a whole great irregular democratic educational system, fitted to the needs of the different localities in a wonderful manner, and meeting the conditions much better than if they were regularly classified and standardized.

Administration.—After a very severe trial, reaching over a period of years, it was found that the inevitable tendency of all industrial schools was to become theoretical and to turn out theoretical students rather than practical men who would be of use in building up the industrial resources and commercial prosperity of the country. The Germans have established, almost universally, local committees of business men, manufacturers and workmen who control these schools wherever they are. The result is that the manufacturers and the working people take the utmost pride and interest in these schools, and watch closely their development. In talking with the heads of the industrial schools in Germany one is impressed by the fact that these men always say that if the employers would only allow them to have the boys for full time, or have them for longer periods and would not interfere so much with the management of the school, they could do splendid work. But the general history of industrial education in this country, as well as the German experience, shows us that if these schools are all put on a full-time basis, the boy who works in the factory and earns his living after he is 14 years of age is gradually crowded out, and schools are

formed which turn out engineers, professional or cultured men, but which do not meet the needs of the great mass of the people. It is far better to have the management of the schools in the hands of the employers and employees than to be hampered by the theoretical standpoint which inevitably would result if the teachers or school men had it all in their own hands.

TEACHERS.—Another great element in the success of this work is the kind of teachers employed. Every means has been used to get the right kind of teachers. Very wisely indeed the Germans have paid the teachers in this work higher wages than for similar grades in the other schools; they have laid the stress and emphasis upon this work. In almost every place one sees men teaching in these schools who are really artists in their work. The committees of manufacturers and employers see to it that this is the case. Special inducements have been held out for good workmen. Private rooms have been furnished in the schools where they can carry on their researches; every man has a studio. Recently special schools for teachers in industrial teaching have been founded, where men and women are specially trained.

TASK SYSTEM.—There is another element which has been neglected by most of the investigators of the German industrial educational system. That is the "task system" which is in vogue there. Small classes of from 16 to 20 are usual, and the "tasks" are assigned for each member in the class. All who are prepared alike begin at the same "task." If a boy has but one day in the week in which to do his work, he can come in and work at his task. When he has finished that, he will go on to the next task. Beside him in the room are men who are perhaps working every day, learning a trade in the trade school. These men of course have many more tasks completed than the part-time student but are under the same teacher. One man may be working at task number 3, another at task number 20, another at task number 60, but 16 of these men constitute one class under one teacher. It is a question of individual ability and the tasks completed rather than a question of a certain amount of time put in to advance a grade. The whole thing adds to the simplicity and economy of management.

SUPPLEMENT TO BIBLIOGRAPHY OF ARTICLES RELATING TO THE STUDY OF CHILDHOOD AND ADOLESCENCE WHICH HAVE BEEN PUBLISHED IN THE PEDAGOGICAL SEMINARY AND THE AMERICAN JOURNAL OF PSYCHOLOGY

1907-1912

In 1907 a bibliography of the University Publications relating to childhood and adolescence was printed in the September number of the Pedagogical Seminary. As, since that date, nearly one hundred additional studies have appeared, the present appendix is issued to bring the bibliography to date.

THEODATE L. SMITH

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In addition to the articles listed many of the addresses given at the Child Conference for Research and Welfare were printed in the Ped. Sem., but as they are all included in the volumes of the conference reports, they have not been listed separately.

BOOK NOTES

Motion Study, a method for increasing the efficiency of the workman, by FRANK B. GILBRETH. New York, 1911, D. Van Nostrand Co. XXIII, 116 p., with introduction by Robert Thurston Kent, Editor of "Industrial Engineering."

Probably no more unique and profitable book of pedagogy has appeared in recent years than Gilbreth's "Motion Study." Its chief purpose is to point out how motions can be economized in the industries and more especially in the brick-laying trade. The text is well illustrated with half-tone cuts which recently appeared with much the same discussion in "Industrial Engineering." While most of the concrete illustrations are drawn from the brick-masons' trade, the work is much broader in scope and is pregnant with suggestions in every other field of human endeavor. The work indicates that Gilbreth is one of the chief authorities on conservation and the earning power of workmen.

The discussion appears under three main heads: First, the *worker,* including his anatomy, creed, contentment, experience, fatigue, habits, health, nutrition, size, etc., as variables affecting the amount of work done; second, *surroundings, tools,* etc., including clothes, letterings and colors, entertainment, heating, size and weight of unit moved, union rules, etc., as a second group of variables; third, *motion,* including acceleration, sequence, direction cost, work accomplished, length, inertia and many others as a third group of variables affecting the earning capacity of the workmen.

The problem is discussed from the humanity standpoint and not with a view to devising means for extorting the last ounce of energy from the laborer. Mr. Gilbreth reports that he has actually succeeded in doubling the efficiency of the workmen and at the same time sending them home in the evening less fatigued than when they worked under the less scientific but more "convenient" regulations. The motions per brick have been reduced from eighteen under the old method to one and three-fourths under the new system.

A single incident related in the introduction will serve to illustrate the wider application of the principles. Gilbreth was attracted in the Japanese-British Exposition to a girl putting papers on blacking boxes at a wonderful speed. He at once timed her, and it required forty seconds to do twenty-four boxes. However, he noticed that her speed was due to quick motions rather than to economy of motions. He interposed and showed the girl how to eliminate half of her motions, and on the first trial she did twenty-four boxes in twenty-six seconds. On the second trial she succeeded in twenty seconds, exactly doubling her output of a few minutes before. She was not working any harder, only making fewer motions.

The only purpose of the review in this connection is the hope that some thoroughly practical educator will become interested and work out the details by which the same conservation principles could be applied to the work of the school-room showing how the highest efficiency could be secured in the movements of teacher, pupils, classes, progress of recitation, convenience of materials, as the conditions would be found in any well ordered school or system of schools. The field is very promising and Mr. Gilbreth himself calls upon universities and university trained men to give their attention to the question in its more scientific aspects.

Much has already been done on two of the variables, but the third suggests a field of unexplored possibilities. The "worker" is being studied by the experts in the hygiene of the school child. The "surroundings, equipments and tools" is fairly well investigated by the students of the hygiene of the school equipment. These are the fields of most marked progress in recent years. No less interesting and valuable would be the subject of the hygiene of school motions for the conservation of the teacher's time and energy, the elimination of loss motion in school routine and the consequent increased efficiency of the school machine. Dinsmore, McMurry, Bagley and others have sensed the problem, but none have attempted its scientific treatment as Gilbert has done in the economic sphere.

The only obvious criticism of the book is in its form. The reader would gladly sacrifice some of the minuteness of detail in the illustrations, to be relieved of the irritating glare of the highly glazed pages. This feature is the more inexcusable in that it violates the author's own scientific findings and recommendations. It is to be hoped that publishers will not afflict the reading public with many such gross violations of the hygiene of reading. One is surprised to read, "there shall not be any polished surfaces in its [light] vicinity that will reflect an unnecessary bright spot anywhere that can be seen by the eyes of the worker," on a page that is impossible to adjust in proper light so that it will not give off bright spots. L. W. SACKETT

Le Croquis à L'Ecole Primaire, par J. J. SAUVAGE, M. ET MME. L. V. VANDENHOUTEN. 1910. 284 p.

This is a very attractive presentation of the possibilities in the use of the barest outline sketches in all primary work. As the teacher talks she now and then represents the crucial points by a few lines, which serve as points of attachment for the children's vivid fancy. Some of the sketches to illustrate moral lessons, are most unconsciously and wittily brief, like the one to show the danger of drinking when one is hot—a running boy indicated by three lines, a glass and then—tragic end—a bed with an enormous bottle even bigger than the bed standing by. So the sad fate of the belligerent goats who met on the narrow bridge is shown by a criss-crossing of upheaving lines very suggestive indeed of the turmoil going on below.

The authors also use sketching to aid observation, representing all the common occurrences of daily life and its tools, utensils, etc. Letter boxes, carnival, streetsweeping, storms, drought, balloons, steamboats, flowers and fruits, animals in whole and part, the human body in the teaching of physiology—in short everything and anything. Nothing is too complex to be shown in a few lines, it would seem.

So where one began with admiration one ends with reservation. The sketches are used in very many instances where any teacher could bring the real object into the school or have the children go to it, and seem to be used instead of the object, not by way merely of recalling it. Again they are used in many cases where a good picture would be far preferable, as in showing the differences and similarities between related animals. In other instances they seem to be used as rather absurd mnemonic devices, for learning poetry, and while the authors say that sketches can not take the place of reasoning in arithmetic, still they seem to think that when Johnny has to find out how much his clothes cost altogether if his shoes cost 10 f., his cap 3 and his suit 16, it somehow helps him to have drawings of shoes, cap and suit with plus signs between. Similarly, 84l. —9l. is indicated by a hogshead and a pail with a minus sign between them.

No one would question for an instant the great value of ability on the part of a teacher to use sketches in the course of a lesson on any subject and at any grade from kindergarten through University. Indeed we seem to have made far more use in this country of drawing as a language than has been done abroad. But to use it so indiscriminately as is done here is, it seems to me, to encourage the teacher to use the easier instead of the better method. If the different forms of leaves or claws are to be taught, she will be satisfied with a rough outline drawing instead of a trip to the woods after the leaves or a searching through zoologies after the claws. And so through the list.

AMY E. TANNER

Woman's Part in Government, whether she votes or not, by WILLIAM H. ALLEN. New York, Dodd, Mead & Co., 1911. vii, 377 p.

In the preface the author states his belief that women will soon be both permitted and expected to vote, but the aim of the book is to show the ineffectiveness of the ballot and the large share women may take and do take to-day in government. Outside interests are now inside the home to stay and the most domestic of women must know enough not to be a problem creator—which can not be done by mere devotion to home or by contemplation of the paradise that lies at the feet of the mother. After discussion of the details of registration and voting, how to avoid fraud in both, protecting and interpreting the vote, qualifications for voters, form of the ballot, and value of initiative, referendum and recall, the author makes the point that the ballot does not make officials do their duty, but that public knowledge of their acts does. Misgovernment is due to public ignorance, and is stopped by getting evidence based upon definite units of inquiry, and using papers and magazines to publish this evidence.

Now, all this in all its details women and women's clubs can do. The ballot does not study proposed laws, nor watch legislation, nor systematize knowledge, nor make budgets, nor attend hearings, nor write reports. If women and women's clubs did these things for their own community they would go far to give it an efficient government, library, charities, and churches.

Ballots do not stop contagion, nor discover disease-bearing water, nor get clean milk, nor keep babies alive, nor detect impure foods and drugs, nor expose patent medicines, nor note factory conditions nor stop child labor nor locate housing evils nor clean streets nor dispose of refuse—but women can do all these things.

The schools, both public and private, need woman's help in just the same way, and so do the courts and police departments and various agencies for the suppression of vice. The author remarks grimly that a high death rate of infants is more indecent than open gambling but that any community that permits open gambling is very unlikely to fight infant mortality.

Altogether, the most ardent advocate of woman's suffrage who reads this book can not but have an uneasy feeling that after all a ballot is rather an ineffective tool as compared with the ability to throw a searchlight upon all forms of official activity. The book is impressive in that every generality is pointed by a series of detailed questions or suggestions, and references to organizations which have done the work under discussion and to the pamphlets describing such work. It tells how things can be done, where they have been done, and the results obtained by the doing. It should be in the library of every woman and woman's club—and it would do men no harm to get a few ideas from it.

AMY E. TANNER

The way of an eagle, by E. M. Dell. New York, G. P. Putnam's Sons, 1912. 406 p.

The theme of this tale is summed up in the quotation from Proverbs: "There be three things which are too wonderful for me, yea, four which I know not: The way of an eagle in the air; the way of a serpent upon a rock; the way of a ship in the midst of the sea; and the way of a man with a maid." The hero combines all these characteristics, showing the boldness of the eagle, the wiliness of the serpent, the staunchness of the good ship, and the love of the man. Other characters are perhaps intended to figure the weaknesses of each, while the heroine is the helpless prey, the fascinated bird, the storm tossed bark and the blushing maid. The plot is very well worked out and holds the reader to the very end.

Manual of style. A compilation of typographical rules governing the publications of the University of Chicago, with specimens of types used at the University Press. 3d ed. Chicago, University of Chicago Press, 1911. 118 p.

This is a codification of the typographical rules employed by the University of Chicago in connection with its official printing of publications issued through the university press. It originated nearly twenty years ago in single sheets of fundamentals jotted down by the first proof-readers, and has grown from year to year. It is a unique book and full of all sorts of information concerning not only kinds of type and style, but also illustrations, with plenty of information on all the topics.

World geography, by Ralph S. Tarr and Frank M. McMurry. New York, The Macmillan Co., 1912. 536 p. (One-volume edition.)

The first 185 pages give the foundation for understanding such common things as food, shelter, soils, hills, valleys, industries, climate, government which are part of every child's environment. Secondly comes mountains, rivers, lakes and oceans. Part Three treats of North America and Part Four of general geography, wind, rain, oceans, races of mankind. Then follows South America, Europe, Africa, Australia and then comes a large collection of colored maps, relief study, maps illustrating climate, products, population and other maps. These are interspersed in the text and carefully chosen, and altogether the volume contains nearly 700 cuts with a voluminous bibliography and an appendix of statistics.

Black and white in South East Africa, by Maurice S. Evans. New York, Longmans, Green & Co., 1911. 341 p.

The underlying idea of this work is that there are social, mental and spiritual as there are obvious physical differences between the Abantu and the Europeans and that it will be most just to both races if the natives are consciously developed on lines indicated by the study of their characteristics than on the assumption that their intelligence and natures are those of white men. These ideas will probably gain the general consent as an abstract proposition, but when it comes to actually enforcing them, there are very great difficulties. After describing the country and the people, tribalism, missions and education, the author discusses the needs of black men and the demands of the white in labor and land, tells how the black man thinks and the effects of his mode of thought upon the white man, discusses past policies and present theories and attempts to peer into the future. It is an interesting and inspiring book.

The negro and his needs, by RAYMOND PATTERSON, with a foreword by William Howard Taft. New York, F. H. Revell Co., 1911. 212 p.

The southern man is too close to the negro, and the northern man too far away. This author seeks the middle ground and from his long experience as a journalist, which is commended by President Taft, his classmate. He discusses the problems of increase, temperament, the mulatto, morally, the environment, economic problems, his relations to the white planter, political issues, suffrage, and what the negro has done for himself, the southerner's point of view, theories, need of education. The latter he conceives as the great need at present.

India under Curzon and after, by LOVAT FRASER. London, William Heinemann, 1911. 496 p.

This volume is a well informed and very sympathetic account of Lord Curzon's rule in India, although Curzon did not suggest it, has not seen a line of it, and he has neither authorized nor inspired a single statement. The writer first describes the condition of things in India before Lord Curzon's day, the latter's preparation, and then his work. This he characterizes by departments, first the North-West Frontier, the tribal country, Chitral and Afghanistan; then Persia, Seistan and Tibet. He then takes up the land question, education, the princes and native states, the reconstruction of the government machinery, the problem of the plague, famine and irrigation, commerce, industry, the physical problems, army reforms and Lord Kitchener, unrest and kindred questions.

Java, Sumatra, and the other Islands of the Dutch East Indies, by A. CABATON. London, T. Fisher Unwin, 1911. 376 p. (Tr., with a preface by Bernard Miall.)

The writer, after generalities and a historical sketch, treats of the physical geography, divisions, natives, the Javanese mind, the oriental foreign element, Europeans, administration, products, forests and mines, other possessions, political and economic conditions of Sumatra, Borneo, Celebes, the Moluccas and Timor. The book has a number of illustrations and a map.

Psychology and pedagogy of writing, by MARY E. THOMPSON. Baltimore, Warwick & York, Inc., 1911. 133 p. (Educational Psychology Monographs.)

The author treats here of the historical development of the alphabet, gives a resumé of the experiments bearing on the psychology of reading and in a final chapter describes its pedagogy. The work was done under the direction of Dean Thomas N. Balliet of the University of New York. It is somewhat elementary, but seems to accomplish very well what it seeks and is a useful tract or pamphlet for teachers.

The utility of all kinds of higher schooling. An investigation by R. T. CRANE. Chicago, 1909. 331 p.

This severest critic which higher education has ever had in this country has brought his material now together in a rather stately book in which he starts with Spencer's definition and Eliot's five-foot shelf of books. Then comes a chapter of opinions of college men and others of those of college graduates, of business men, and criticism of their letters, on misrepresentations, professional men, college training and character, the making of statesmen and orators. He then takes up technical, medical, and scientific training, agriculture and manual training, tells how the University of Wisconsin "defrauds the state," and finally gives us a conclusion of the whole matter.

A primer of teaching practice, by J. A. Green and C. Birchenough. New York, Longmans, Green & Co., 1911. 262 p., illustrated.

This book is the outcome of many attempts to organize the professional work of training college students. It does not offer a new theory of education but merely surveys the variety of activities that enter into the complex work of class teaching. The different chapters are efforts to treat these activities in isolation, feeling that it is best to attack them one by one. It is not intended to supplant the study of special preparation or courses of psychology, but rather to be a preparation for both. Among these chapters are work and play, narration, description, explanation, observation, expression, imitation, inference, investigation, questioning, corrections, illustrations, discipline.

Outlines of school administration, by Arthur C. Perry, Jr. New York, The Macmillan Company, 1912. 452 p.

This is designed as a text-book upon the subject. Under Part 1, Organization, the author discusses the organic structure of the school system of the United States, Germany, France, Great Britain and other countries and the curriculum, in infant, elementary, secondary, higher and vocational education and also the normal public education in this country and elsewhere. Part Second treats of school direction in the United States and other countries; Part Three of supervision; Part Four of management; and Part Five of the training and status of teachers.

A joysome history of education, for use in schools and small families, to which is appended a somewhat hilarious appendix, by Welland Hendrick. Nyack, N. Y., The Point of View, 1911. 67 p.

In this little book an author has indulged to the full a very quiet and rather effective sense of humor, of which it is difficult to give any adequate conception in a note. The natal morn of education was when the first mother "briskly laid the flat of her hand upon the most inviting rotundity of (their) children's bodies." A page or two are devoted to Jews, Greeks, Middle Ages, Rousseau, Komensky, Froebel, Herbart, and the rest is on modern teaching. A special skit is on "Pedaguese" at the expense of English by a Professor "O'Shaw" or something like it, where one claim gives the original and the other the meaning. A comic vocabulary is appended which is rather racy.

Some fundamental verities in education, by Maximilian P. E. Groszmann. Boston, Richard G. Badger, 1911. 118 p.

The writer here sets forth his pedagogical views with the endorsement of several prominent educators. Part one is devoted to manual culture and sense training; part two to culture and art expression. The work contains some thirty illustrations.

Studies in the history of classical teaching. Irish and continental, 1500-1700. By Rev. T. Corcoran, S. J. New York, Benziger Bros., n. d. 306 p.

This is historical, going back to William Bathe of Dublin, 1564-1614. Then comes the practice of classical education in the post-Renaissance period, and then there are various appendices. It is an interesting and thorough historical sketch.

The educational system of China, as recently reconstructed, by HARRY EDWIN KING. Washington, Govt. Printing Office, 1911. 105 p. (U. S. Bureau of Education Bull., 1911. No. 15, Whole No. 462.)

The first chapter treats of the growth of modern education in China up to 1898, then discusses the next two years which were those of reforms and then the development of modern education from 1900-1906, controlling agencies, primary, middle, collegiate, normal, technical and miscellaneous schools, Chinese students studying abroad. It is a timely paper.

Great educators of three centuries, by FRANK PIERREPONT GRAVES. New York, The Macmillan Co., 1912. 289 p.

This is an account of fourteen of the great educators from Milton to Spencer. It includes Francis Bacon, Ratich, Comenius, Locke, Francke, Rousseau, Basedow, Froebel, Lancaster, Bell and Horace Mann. It was well worth while to do these autobiographically and to bring them into a more accessible form and the work seems to be well done.

The social factors affecting special supervision in the public schools of the United States, by WALTER HENRY JESSUP. Columbia University, Contributions to Education, No. 43. N. Y., Teachers College, 1911. 123 p.

The author takes up music, drawing, manual training, domestic science, physical education, penmanship, distribution of specialists, salaries, sex selection, division of responsibility, with summaries and conclusions. He seeks to find sanctions back of the demand for the introduction of these subjects, and to find whether this demand comes from the school or outside, to point out typical ways of introducing new topics, and to determine their effects and certain quantitative aspects of the subject.

Provision for exceptional children in public schools, by JAMES H. VAN SICKLE, LIGHTNER WITMER and LEONARD P. AYRES. Washington, Govt. Printing Office, 1911. 92 p. (U. S. Bureau of Education, Bull., 1911. No. 14, Whole No. 462.)

The authors treat of the discovery of the exceptional children and their probable relations to normal children, classification methods of determining extent and degree, provision in school systems, grading and promotion, description of work done for exceptional children in about thirty cities.

The causes of the elimination of students in public secondary schools of New York city, by JOSEPH KING VAN DENBURG. New York, Teachers College, Columbia University, 1911. 206 p.

Part One is devoted to the study of entering population. Then follow the elimination, advancement in the school course, early promise, first term's mark, the human side.

Children at play and other sketches, by ROSE M. BRADLEY. London, Smith, Elder & Co., 1911. 316 p.

The chapters are: London children at play, Matty of Spitalfields, the children of Florence, Sienna and her children, days in a Paris convent, fête day at Avignon, day in Provence, the month of Mary, Frère Jacques, on the road in Corsica.

The use of the bible in the education of the young, by T. RAYMONT. New York, Longmans, Green & Co., 1911. 254 p.

No educational writer hitherto has dealt with the subject of Bible teaching from his own special point of view. Here, however, we have in Part I the Old Testament, its literary aspects and a teacher's survey. The New is treated in the same way and in the last part, the writer gives a course of instruction and preparation for the teacher, a mode of presentation, with bibliography, chronological tables and a comparative view of schemes treated in an appendix.

Child nature and child nurture, by EDWARD PORTER ST. JOHN. Boston, Pilgrim Press, 1911. 106 p.

After distinguishing nature and nurture the writer discusses the instincts that are associated with physical life, the appetite, nervousness, sex; then how to deal with the child's fears, then with its anger, then with the love impulse, then how to train in kindness and unselfishness and respecting property rights. The plan is unique, direct, and we should think would be most effective. It certainly marks a new departure in work of this kind and ought to be read by everyone interested in the moral and religious training of children.

The problem of race-regeneration, by HAVELOCK ELLIS. 71 p. And *The methods of race-regeneration,* by C. W. SALEEBY. 63 p. (New Tracts for the Times). London, Cassell & Co., Limited, 1911.

These two books are New Tracts for the Times and sold at sixpence in England. Ten other pamphlets are in preparation on the relations of race-regeneration to national ideals, spiritual life, womanhood, education, social development, moral progress, religion, sex, industrialism, birthrate. In the first tract Ellis treats the improvement of the environment, problems of to-day, next step in social reform, eugenics; and in the second Saleeby treats of natural and secondary methods of race-regeneration, first essentials, the positive or Galtonian methods, and negative methods, and preventive methods and racial poisons.

The declining birthrate; its national and international significance. By A. NEWSHOLME. New York, Cassell & Co., Ltd., 1911. 64 p. (New Tracts of the Times.)

The writer first reviews the rates of national increase of population and measures the effects of declining contributions of birth rates in different countries and towns, causes of reduction, indirect factors, possible effects of altered distribution of fertility, national and international forecasts and finally discusses some possibility of action.

We and our children, by WOODS HUTCHINSON. New York, Doubleday, Page & Co., 1911. 371 p.

The sequence of themes is: before the little one comes, babies as bulbs, the nursery age, the sweet tooth, kindergarten age, feeding the human caterpillar, our ivory keepers at the gate, the child's self-respect, brick walls and the growing child, eyes and ears, the worship of the race stream, reluctant mothers, the American mother, the delicate child, fiction as a diet, overworked children in farm and school.

A digest of the laws and regulations of the various states relating to the reporting of cases of sickness, by JOHN W. TRASK. Washington, Govt. Printing Office, 1911. 191 p. (Public Health Bulletin, No. 45.)

This is an abstract of the state and territorial laws relating to the reporting of sickness to the health authorities to and through whom cases are reported, following the states in alphabetical order.

Tom and Tom Tit and other stories about schools, by C. W. BARDEEN. Syracuse, N. Y., C. W. Bardeen, Publisher, 1911. 286 p.

Editor Bardeen has here produced a number of very interesting school stories. He is preeminently the story writer of all American teachers.

Adolescence; being selections from the occasional poems and meditations of the author to his twenty-fifth year. By WERNER MATTHEWS. Cambridge, England, printed by Fabb & Tyler, 1911. 148 p.

This volume, consisting mostly of poems, is a contribution to the psychology of adolescence. It is interesting and typical. It abounds in aphorisms and enthusiasms and experiments with all sorts of rhyme and poetry.

The hygiene of the soul, by GUSTAV POLLAK. New York, Dodd, Mead & Co., 1910. 209 p.

This book is really an account of the life, character and writings of Feuchtersleben, the author of "The Dietetics of the Soul" which is here translated and epitomized. The work excited a merited attention in its day.

Poems of action. A collection of verses for youth, chosen and edited by DAVID R. PORTER. New York, Association Press, 124 E. 28th St., 1911. 259 p.

This author attempts to bring together all the poets using the English language which mature boys enjoy reading. It is a book for older boys but it is a little difficult to know precisely how he determined his choice of poems. On the whole his selections seem to be excellent.

Productive farming, by KARY CADMUS DAVIS. Philadelphia, J. B. Lippincott & Co., 1911. 357 p.

This book is intended to suit the needs of rural schools of all kinds and graded village and city schools chiefly below high school rank. Its parts are plant production, animal production, animal products, farm management, with an appendix and reference tables. The book is copiously illustrated and is in every way attractive.

Some old Egyptian libraries, by ERNEST CUSHING RICHARDSON. New York, Charles Scribner's Sons, 1911. 93 p.

This is an interesting research in an interesting subject which the author has treated in a very scholarly way.

Increasing human efficiency in business. A contribution to the psychology of business. By WALTER DILL SCOTT. New York, Macmillan, 1911. 339 p.

The writer discusses in successive chapters the possibility of increasing human efficiency and then imitation, competition, loyalty, concentration, wages, and pleasure, as means of increasing human efficiency. Then the relations between the latter and love of the game, relaxation, rate of movement, practice versus theory, making experience an asset, capitalizing it, and finally judgment and habit formation.

Commentary on the science of organization and business development, by ROBERT J. FRANK. Revised edition. Chicago, Chicago Commercial Publishing Co., 1910. 277 p.

This work treats first of organization, then in successive chapters of coöperate financing, management, re-organization and consolidation, and promotion of enterprises, with an appendix. It is a valuable addition to the now rapidly growing literature upon this subject.

Self-investment, by ORISON SWETT MARDEN. New York, Thomas Y. Crowell Co., 1911. 315 p.

This is a series of vocation talks to young people apparently on how to utilize their powers, what to do with their time, how to read, etc.

Whence and whither, or the evolution of life, by THOMAS F. NEIL. Altoona, Pa., Mirror Printing Co., n. d. 62 p.

This booklet presents the author's struggle for a comprehension of life. Beliefs must come from individual experience and from this point of view he gives his notions of the origin and progress of man, the progress of the soul, of religion, and the progress of civilization.

Circumstances or character, by CLEMENT F. ROGERS. London, Methuen & Co., 1911. 218 p.

The writer first states some fundamental principles, then discusses charity in the church, religion and belief and finally, order and disorder.

Heroes of everyday life, by FANNY E. COE. Boston, Ginn & Company, 1911. 169 p.

The diver, telegraph operator, civil engineer, day laborer, life saver, fireman, engineer at sea and the miner are discussed by different writers in a way to show the heroism that is often necessary and rarely wanting where heroism is needed in the active pursuit of their occupations.

Home life in all lands, by CHARLES MORRIS. Philadelphia, J. B. Lippincott Co., 1911. 344 p. (Book III, Animal Friends and Helpers.)

In the earlier volumes of the series, man as a maker of and dweller in the home was dealt with, but animals too have their home and home life and it is of this that this book treats. The chapters are household pets and comrades, our single hoofed helpers, cloven hoofed draught animals, animals which yield food, birds of the poultry yard, tuneful home pets, our cousin the monkey, other animals as pets, wild animals in man's service.

Wit and wisdom of G. K. Chesterton. New York, Dodd, Mead & Company, 1911. 233 p.

Farm mechanics and drawing. Syllabus for secondary schools, 1911. Education Department bulletin. Published fortnightly by the University of the State of New York. Number 500, Albany, N. Y., August 1, 1911. 32 p.

Six thousand common English words; their comparative frequency and what can be done with them. By R. C. ELDRIDGE. Niagara Falls, N. Y. 64 p.

The aims, values and methods of teaching psychology in a normal school, by J. MACE ANDRESS. Rep. from December, 1911, Journal of Educational Psychology, pp. 541-554.

United States history for schools, by EDMUND S. MEANY.. Ill. New York, Macmillan Co., 1912. 587 p.

L'education commune a' Buenos Aires, par PABLO A. PIZZURNO. Buenos Ayres, Attliers due Bureau Météorlogique Argentin, 1910. 87 p. (Extrait du Recensement Général L'Education Levé le 23 Mai 1909.)

Ophthalmia neonatorum, by J. W. KERR. Washington, Govt. Printing Office, 1911. 20 p. (Public Health Bulletin, No. 49, October, 1911.)

Proceedings of the Massachusetts Historical Society, October, 1910-*June,* 1911. Vol. XLIV. Boston, published by the Society, 1911. 787 p.

The report of the Philadelphia milk show; its organization, management and a description of the exhibits, edited by ARTHUR EDWIN POST. Ill. Published by the Executive Committee, 1911. 123 p.

The eight pillars of prosperity, by JAMES ALLEN. New York, Thomas Y. Crowell Co., 1911. 233 p.

Address by President Stewardson, of Hobart College, in memory of Henry Langdon Parker, with the proceedings of the Worcester County Bar and Superior Court. Worcester, Mass., 1911. 27 p.

NOTES

The activity in the field of experimental pedagogy in Russia is well illustrated by the Proceedings of the First Pan-Russian Convention of Experimental Pedagogy (held at St. Petersburg, December 26-31, 1910) 1911, which has just come to hand.

The contents of the volume are as follows:

THE FIRST MEETING. DECEMBER 26TH, 1910

G. E. ROSSOLIMO. "Types of Profiles of Psychically Deficient Pupils.
A. M. SHUBERT. "An attempt at Application of the System of Binet to the Investigation of the Abilities of Defective Children."
N. P. POSTOVSKY. "On Modifications in the Method of Sante De Sanctis for the Determination of the Anomalous Degrees of Intellect and Its Normal Level in Children of School Age."

THE SECOND MEETING. DECEMBER 27TH, 1910

A. A. SHCHEGLOV. "Heightened Liability to Fatigue of Pupils as a Symptom of Social Degeneration."
A. B. VLADIMIZSKY. "The Problems of Neuro-Psychical Hygiene in Contemporary Pedagogical Life."
F. E. RIBAKOFF. "Capacity for Mental Work of Men Students and Women Students, members of the Higher Courses for Women." The women students of these courses are called, in distinction from men students in universities proper—*coursistes*.
A. F. IAZUZSKY. "On the Natural Experiment."
A. P. NETSCHAEV and G. M. MININKHIN. "Observation upon the Reading of Children, as one of the Forms of the Natural Experiment."

THE THIRD MEETING. DECEMBER 28TH, 1910

P. TSONEV. "On Experimental Investigations of the Teaching of Free-Hand Drawing in Connection with Modelling."
A. H. KROGIUS. "Experimental Investigation of the Processes of Thinking."
P. E. LEIKFELD. "The Law of Weber and the Law of Merkel."
G. E. TROSHIN. "On the Child's Induction."
I. I. VABALASS-GAUDEITISS. "A New Apparatus for the Investigation of Attention."

THE FOURTH MEETING. DECEMBER 29TH, 1910

I. V. EVERGETOV. "Experiment and Its Significance in the Solution of Questions of Moral Education."
N. S. MALTSEV. "On the Activity of the Belgian Pedotechnical Society."
A. L. SHCHEGLOV. "On the Investigation of Muscular Power and Muscular Fatigue in Schools."
T. K. MARKAZIANTZ. "The Capacity for Work of Adults and Children in Different Hours of the Day."

THE FIFTH MEETING. DECEMBER 30TH, 1910

L. G. ORSHANSKY. "On the Pedagogical Significance of the Development of the Left Hand."

L. G. Orshansky. "On Collection and Study of Children's Toys as Material for the Study of Child Psychics."
A. P. Netschaev. "On an Experimental School at the Pedagogical Academy."
G. E. Rossolimo. "An Attempt at Experimental Investigation of Candidates from Peasants' Boys for Scholarships in the Society of the Name of Lomonossoff in Moscow."
V. P. Kastchenko. "Should the Gifted Children be Singled out from the General Mass of Scholars?"

The Sixth Meeting. December 31st, 1910

M. L. Morosov. "Concerning the Problem of an Inquiry among Backward and Abnormal Children in Elementary Schools."
K. I. Shidlovsky. "History of Organization of Auxiliary Schools in Moscow."
A. N. Bagenov. "Organization of Auxiliary Classes for the Mentally Retarded."
F. A. Galinovsky. "Selection of Children for Auxiliary Classes."
V. P. Kastchenko. "Determination of the Degree of Mental Deficiency by the Method of De Sanctis."
V. P. Brajass. "Experimental Psychological Investigations of Color Sensations in Children."
A. I. Zatchiniaev. "On the Psychological Foundations of Teaching the Written Expression of Thought.
A. V. Vladimizsky. "Concerning the System of Experimental Investigation of Personality." The Program of Lectures by Dr. R. Sommer.

The Board of Directors of the recently organized Kindergarten Association, 1 Madison Avenue, New York City, offer three prizes for essays on the benefits of the Kindergarten and suggest the following subjects: 1. Why should all our schools have Kindergartens? 2. What the Kindergarten does for the child. 3. The influence of the Kindergarten on the home. 4. The Kindergarten as an uplifting influence in the community. The prizes are: first, $100; second, $50; and third, $25; and the contest is open to all Kindergartners and Primary Teachers. Essays should not contain more than fifteen hundred words, written on one side of the paper only, and should be received by the Association not later than April 15th, 1912.

A new school of the science of education has recently been established at Geneva under the name of Institut J. J. Rousseau. Dr. Pierre Bovet has been called from the professorship of philosophy and pedagogy at the University of Neuchatel to assume the directorship. Professor Ed. Claperéde, professor of experimental psychology at the University of Geneva, is one of the teaching corps. The Institut will be both a school and a center for research. The principal subjects taught will be psychology, including general and child psychology, together with practice in the psychological laboratory and anthropometry as applied to schools; school hygiene with practical instruction on the diseases of children; a clinical and pedagogical course on backward and abnormal children; moral and social education; history and philosophy of the great educators; school administration and organization.